

Liaoning Panjin Urban Climate Resilience with Nature Based Approaches for Sustainable Municipal Service Infrastructure

Environment and Social Impact Assessment & Environment and Social Management Plan
(final draft)

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ABBREVIATIONS

AIIB	Asian Infrastructure Investment Bank
AP	Affected People
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
CSC	Construction Supervision Company
CUCD	China Urban Construction Design & Research Institute Co., Ltd.
EA	Executive Agency
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMDP	Ethnic Minority Development Plan
ESF	Environment and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMoP	Environmental and Social Monitoring Plan
ESSs	Environmental and Social Standards
ESP	Environmental and Social Policies
E&S	Environmental and Social
FGD	Focus Group Discussion
FSR	Feasibility Study Report
GAP	Gender Action Plan
GRM	Grievance Redress Mechanism
IA	Implementation Agency
O&M	Operation and Maintenance
PIU	Project Implementation Unit
PLG	Project Leading Group
PMC	Project Management Consultant
PMO	Project Management Office
PPM	Project-Affected Person's Mechanism
PRC	People's Republic of China
RP	Resettlement Plan
SIA	Social Impact Assessment
SS	Suspended Solid
THC	Total Hydrocarbon
TSP	Total Suspended Particulates

WHO

World Health Organization

WWTP

Wastewater Treatment Plant

GLOSSARY

No.	Item	Definition
1	Wetlands	Natural or artificial, perennial or seasonal waterlogged areas or waters with significant ecological functions, including sea areas with a water depth of no more than six meters at low tide, but excluding paddy fields and artificial waters and tidal flats used for aquaculture. China implements a hierarchical management and listing system for wetlands.
2	Important wetlands	China implements hierarchical management of wetlands, and divides wetlands into important wetlands and general wetlands according to their ecological location, area, and the importance of maintaining ecological functions and biodiversity. Important wetlands include national important wetlands and provincial important wetlands, and wetlands other than important wetlands are general wetlands. Important wetlands are included in the ecological protection red line according to law.
3	Urban Wetlands	Urban wetlands refer to artificial, semi-artificial or natural wetlands remaining from urban construction that are distributed in urban (town) areas, influenced by cities, and are significantly different from natural wetlands in terms of ecological attributes, landscape patterns and functional services. They include lakes, rivers, swamps, ponds, reservoirs, reservoirs, ditches, canals and urban coastal wetlands.
4	Combined Sewer System	Combined Sewer System (CSS) refers to a drainage system model in which rainwater and sewage are collected and transported through the same pipe network. The system can effectively treat sewage when it is operating normally in dry weather, but when rainfall increases, rainwater will mix with sewage and enter the sewage treatment plant. If the rainfall is too heavy and the capacity of the sewer pipes is exceeded, it may cause overflow pollution and discharge untreated rainwater and sewage directly into the water body.
5	Sponge Square	The sponge square uses permeable paving, green vegetation, sunken green space and rain garden design elements to allow rainwater to quickly penetrate into the ground and be stored in the underground water storage facilities to prevent ground waterlogging and excessive drainage pressure. The square can contain multifunctional rainwater retention facilities such as ecological wetlands, water storage modules and aquatic plant pools to slow release and purify rainwater.
6	Sponge road	Sponge roads use permeable pavement, ecological ditches, sunken green belts and rain gardens to allow rainwater to seep into the ground from the road surface, slowing down the runoff of urban roads. Such roads generally use materials such as permeable

		asphalt and permeable concrete, supplemented by bioretention facilities and vegetation belts, to effectively control the runoff after rainfall and reduce surface waterlogging. The design concept of sponge roads is to transform rainwater into resources, infiltrate into the soil to replenish groundwater, and reduce runoff pollution caused by heavy rain.
7	Eco-dredging	Eco-dredging is an ecological rehabilitation engineering that adopts eco-friendly construction machines to remove the sludge under the canals, providing a good condition for the rehabilitation of aquatic ecosystem.

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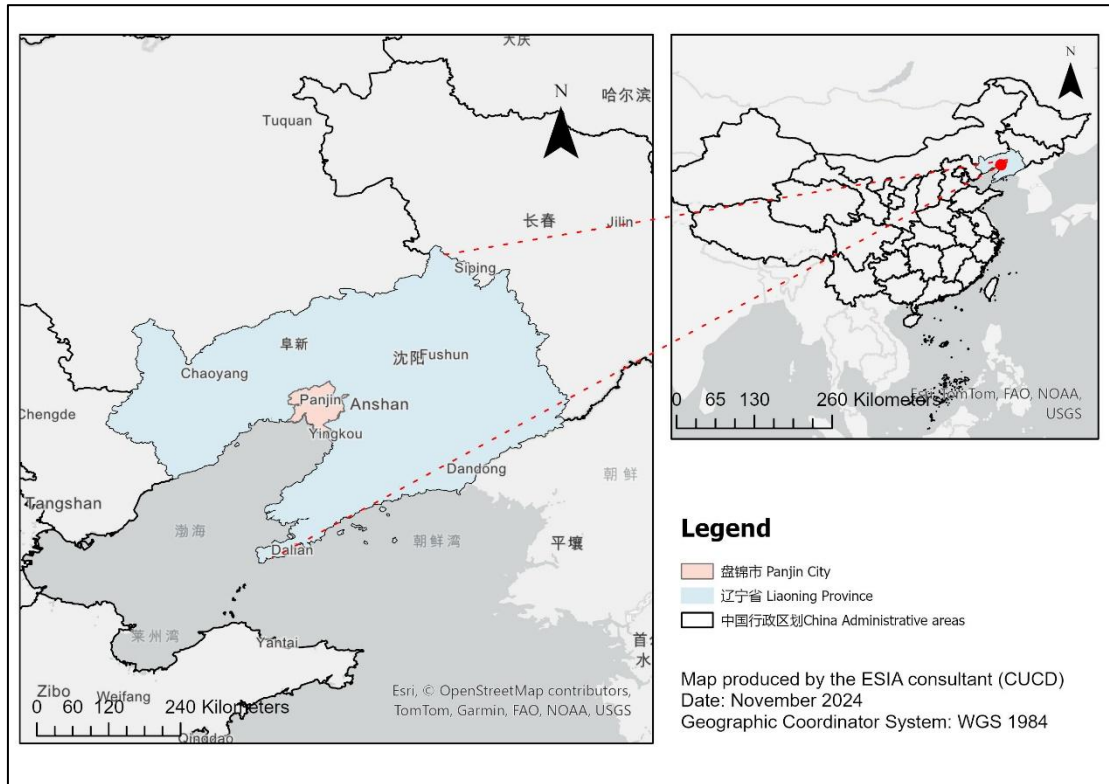
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Executive Summary

A.Introduction

1.The "Asian Infrastructure Investment Bank (AIIB) Loan Liaoning Panjin Urban Climate Resilience with Nature Based Approaches for Sustainable Municipal Service Infrastructure" (hereinafter referred to as the "this project"), was officially included in the "Asian Infrastructure Investment Bank (AIIB) Loan Planning for 2022-2024" on September 5, 2022. The loan amount is 200 million US dollars.

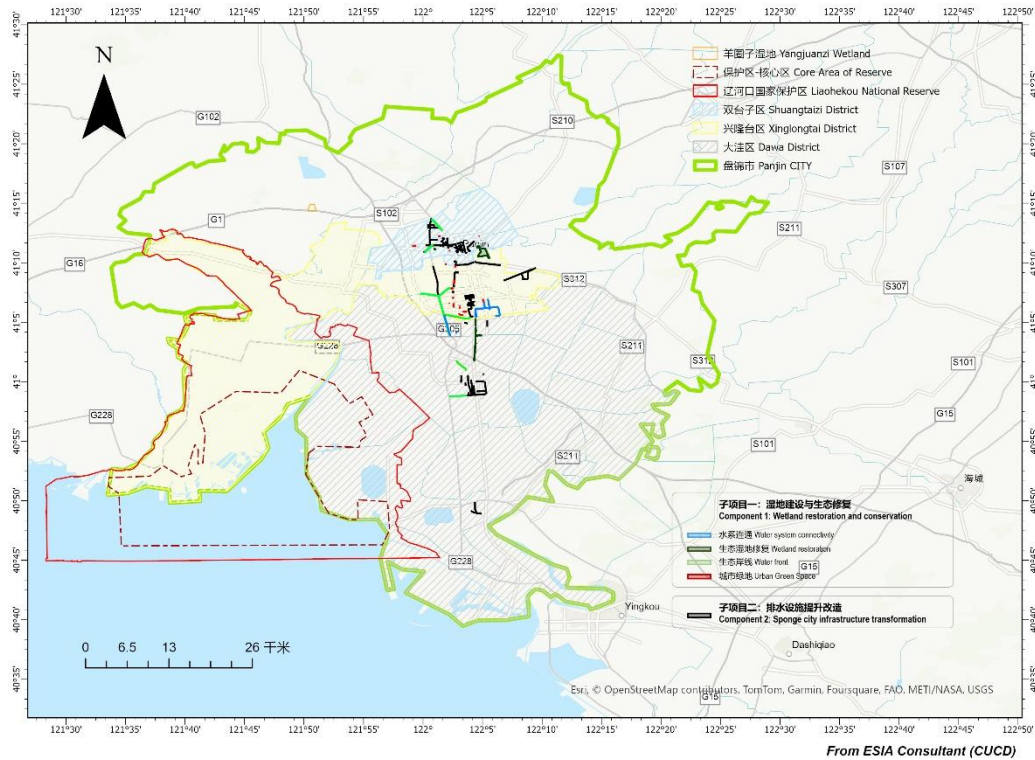
2.The project is located in the urban area of Panjin City, Liaoning Province, China. Panjin City is located in northeast China, southwest of Liaoning Province, and the center of Liaohe River Delta. Its geographical coordinates are between 121°25' E to 122°31' E, and 40°39' N to 41°27'N. The geographical location of Panjin City is shown in Figure ES-1.



Source: ESIA unit, November 2024

Figure ES - 1 Location map of Panjin City, Liaoning Province

3.The project scope covers the urban areas of Shuangtaizi District, Xinglongtai District and Dawa District of Panjin City from north to south. The closest distance between the project site and the Liaohokou National Nature Reserve is about 15 kilometers (ES-2). This project does not involve nature reserves, important wetlands and ecological red lines.



Source: ESIA Unit, November 2024

Figure ES -2 The project construction site

4.The project is widely distributed in the urban area of Panjin, affecting large areas. The land acquisition and demolition involve 83 households and 244 people in Shuangtaizi District, Xinglongtai District and Dawa District. According to the Environmental and Social Policy (ESP) of the Asian Infrastructure Investment Bank (AIIB), this project is classified as an environmental and social Category A project, and a detailed environmental and social impact assessment is required. This report is an Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) prepared for this project in accordance with the requirements of the AIIB's ESP, Environmental and Social Standards (ESSs) and domestic environmental and social laws, regulations and policies. The basis for the preparation of this report includes: the feasibility study report (FSR), the field investigation and findings of the ESIA team of this project (China Urban Construction & Design Research Institute Co., Ltd, hereinafter referred to as the "ESIA unit"), public engagement surveys and seminars, and other information sources such as literature research.

5.The report covers the applicable legal and regulatory framework, project description, alternative analysis, environmental and social status, environmental and social impacts and corresponding mitigation measures, labor occupational safety and health, environmental and social management plan, stakeholder engagement and information disclosure, grievances redress mechanism, etc. Relevant mitigation measures have been incorporated into the environmental and social management plan to avoid, mitigate and compensate for the potential adverse impacts of the project and its activities on the natural and social environment.

B.Project Description

6.This Project involves four components: (i) wetland restoration and conservation, (ii) sponge city infrastructure transformation, (iii) digitalization of urban drainage management system, (iv) capacity building.

Component 1:Wetland restoration and conservation. This project includes five urban drainage canal connection projects, including the Yijiang Road water system connection project. By building about 5.1 km of new rainwater pipes, 1.42 km of new sewage pipes, renovating about 8.3 km of existing open channels, building 0.98 km of new culverts, renovating 0.4 km of culverts, and building 1.481 km of new roads, the effective connection between urban drainage canals is achieved; the landscape of four urban

wetland parks (Liaohe Sluice Park, Liaohe Stele Forest Park, Tianjia Ecological Corridor, and Hundred Mu Lotus Pond) is improved, totaling 149.8 hm²; through five ecological shoreline projects, including the urban north drainage slope protection project, 2.1 km of urban canal slope protection and 17.2 km of riverbank landscape are improved; two urban ecological green island projects in Shuangtaizi District and Xinglongtai District, the project renovates a total of 21 urban green spaces and builds a total urban street green space area of 13.3 hm².

Component 2: Sponge city infrastructure transformation. This project involves six urban drainage zones: Yitong River, Liaohe River, Pangxieyou River, South Ring River, Qingshui River and Zhaoquan River. This project intends to complete the rainwater and sewage diversion renovation project within the urban area; a total of about 88.2km of new rainwater pipes, about 39.8km of new sewage pipes will be constructed; 2626 m of new culverts, and 60 m of new open channels will be built; 8 new pumping stations will be built and 3 pumping stations will be rebuilt; the main facilities and equipment of 46 pumping stations will be replaced, and three regulating and storage tanks with each volume of 5000 m³ and a regulating and storage tank with the volume of 3000 m³ will be added. In addition, this project also involves a new road with a length of 760 m.

Component 3: Digitalization of urban drainage management system. The component intends to build a digital infrastructure management platform for Panjin City, integrating the management of drainage facility assets and drainage household information, and constructing drainage facility three-dimensional visualization, grid inspection and maintenance, dynamic operation monitoring and early warning, and joint dispatch modules.

Component 4: Capacity building. Including: 1) Hiring a project implementation management team to assist the project office, implementation units and business to manage projects in accordance with AIIB policies and rules; 2) Provide technical training for management personnel Organize technical personnel and management personnel of stakeholders to carry out technical training on AIIB policies and related fields; 3) Organize technical personnel and management personnel of stakeholders to select domestic demonstration projects or demonstration cities for field visits and learning, so as to enhance the management and technical service capabilities of management personnel and technical personnel of relevant stakeholders.

7.The total investment of this Project is 2224.99 million yuan, of which the AIIB loan is 200 million US dollars, equivalent to about 143,870 million yuan, and the counterpart fund is about 786.29 million yuan. The construction period of the project is from December 2025 to December 2030. The People's Government of Panjin is the executive agency (EA), the Panjin Municipal Construction Group (PMCG) is the project implementation unit (PIU).

8.After the implementation of the project, the drainage capacity of the urban water system will be significantly improved, the area of inundation will be reduced, and the city's climate resilience will be enhanced. Through wetland restoration and conservation project, the connectivity between green space and water systems will be increased, the water ecological environment will be improved, and more suitable habitats will be provided for birds and other creatures, promoting the development of regional biodiversity. Measures such as stormwater and sewage diversion and transformation will help reduce sewage overflow, reduce pollution load, improve the water quality of the Liaohe River Estuary Wetland, and promote the improvement of the downstream wetland ecological environment. This project will provide more green space for Panjin residents, improve the ecological environment, and enhance residents' happiness and quality of life.

C.Environmental and Social Status

9.Ecological environment. The scope of this project is located in the urban industrial development zone defined in the "Panjin City Land Space Master Plan (2021-2035)". The dominant habitats within the project scope are urban residences, industrial land, and paddy fields. The wetlands involved in this project are all urban green spaces and artificial wetlands in the urban development zone. No national key protected wild plants are found within the project scope, and no natural forests are found in the project site. Common plants such as poplars and reeds are mostly distributed in the project sites of wetland restoration and park landscape subprojects and their surroundings. The habitat types in infrastructure project areas such as pipelines, pumping stations, and roads are mainly artificial green

vegetation systems.

10. The bird species in the urban wetland park project include gray magpie, great reed warbler, little egret, little grebe, lapwing, common tern, brown-headed jaybill, etc. The great reed warbler is the dominant species in summer. The representative species on both sides of the road and in the artificial forest area in the project evaluation area include gray magpie, magpie, shrike, etc. The representative bird species in the riverside canals project include grass egret, great egret, pond heron, common kingfisher, etc.

11. There is one internationally important wetland and one general wetland in Panjin City. The closest distance between the project and the important wetland Liaohekou National Nature Reserve is about 15 kilometers. There is no nature reserve within the scope of this project, and it does not involve ecological red lines.

12. Current environmental quality. The current environmental quality monitoring data for this project mainly refers to the following reports and sources: monitoring data from the Panjin Ecological Environment Bureau, and data from the environmental impact assessment report for the integrated protection and restoration project for mountains, waters, forests, farmlands, lakes, grasslands, and deserts in the Liaohe River Basin (Huntai River System) (downstream of Panjin section).

- (i) Air quality: In 2023, Panjin City had 309 days with good ambient air quality, with a good rate of 84.7%. Among the days with mild pollution or above, the days with ozone (O_3) as the primary pollutant accounted for 51.8%, followed by $PM_{2.5}$ (30.3%) and PM_{10} (17.9%). The annual average concentration of $PM_{2.5}$ exceeded the standard by $29\mu g/m^3$, and the other major pollutants such as PM_{10} ($48\mu g/m^3$), SO_2 ($10\mu g/m^3$), NO_2 ($28\mu g/m^3$), CO ($1200\mu g/m^3$) and O_3 ($156\mu g/m^3$) all met the standards.
- (ii) Acoustic environment quality: Among the monitoring points in Shuangtaizi District, Xinglongtai District and Dawa District, most of the day and night noise data meet the Class II area standards of the "Acoustic Environment Quality Standards", with the equivalent sound level below 60 decibels during the day and below 50 decibels at night. However, some points exceed the standard, and the main noise source is social life noise.
- (iii) Surface water environmental quality: The overall surface water quality in the project area is Class IV water quality. Indicators such as pH, ammonia nitrogen, COD, and BOD_5 meet the requirements of Class IV and V in the "Surface Water Environmental Quality Standard" (GB3838-2002), but the total nitrogen content exceeds the standard.
- (iv) Sediment environmental quality: Sediment meets the requirements of the Soil Environmental Quality Standards. The relevant standards in the "Agricultural Land Soil Pollution Risk Control Standard" (GB15618-2018) and "Greening Planting Soil" (CJ/T340) are met and no exceeding of the standards was found.
- (v) Groundwater environmental quality: The groundwater quality meets Class III standards in the Groundwater Quality Standard (GB/T14848-2017), and the petroleum content meets the Drinking Water Quality Standard (GB5749-2022).
- (vi) Soil environmental quality: Soil monitoring indicators are all lower than the Soil Environmental Quality Agricultural Land Soil Pollution Risk Control Standards (Trial) and Soil Environmental Quality According to the relevant screening values in the "Soil Pollution Risk Control Standards for Construction Land (Trial)", the soil pollution risk is low and the overall quality is good.

13. Socio-economic environment. By the end of 2023, Panjin City has a total of 478,000 households and 1,285,000 people, including 634,900 males and 650,100 females. This project involves 17 towns/subdistricts in Shuangtaizi District, Xinglongtai District, and Dawa District of Panjin City. The direct beneficiary population along the project in the three project areas is about 879,914, including 731 ethnic minorities. Among them, the ethnic minorities are mainly scattered Koreans (accounting for 99.79% of the minority population in the project area) and Mongolians, accounting for 0.003% of the total population. There are no concentrated ethnic minority populations in the project area, so this project does not trigger the ESS3 ethnic minority standard.

D.Environmental and Social Impacts and Mitigation Measures

14. Positive impact: This project will actively promote the sustainable development of urban ecology and enhance climate resilience through a series of comprehensive measures such as urban wetland

construction, ecological restoration, and drainage system transformation, especially the improvement of the ecological environment of the downstream Liaohe River Estuary wetland.

(i) Improving urban biodiversity: Panjin has built many water environment parks, scenic spots and channels in the urban area, providing a relatively rich habitat space for urban birds. The water quality of some canals and channels is currently poor. Component 1 Wetland Restoration and Conservation Project will increase green space by 136,172 m², including 21 urban ecological green islands with a total area of 133,028 m², and one green space restoration project involving pipelines with a total area of 3,144 m². The total green area (including wetlands) to be improved is 1.4976 million m², and the total length of connected water systems and canals will reach 25,587 m. It is estimated that the urban ecological riverbank rate can be increased to 45.18%. By increasing the connectivity of water systems in various urban blocks and improving the water ecological environment, it will bring significant benefits to urban biodiversity in many aspects.

(ii) Improving urban climate resilience: The built-up area of Panjin City is flat, and the existing drainage system cannot meet the demand, leading to flood disasters in extreme weather such as heavy rain. Component 2 Sponge city infrastructure transformation project will separate stormwater and sewage in the urban drainage network, renovate drainage channels and drainage pumping stations, and open up the urban water system, so that the drainage capacity of Panjin City's water system can effectively address the current 30-year-return rainfall and the 20-year-return rainfall in the next 30 years under the climate change; the number of urban waterlogging points has been reduced from 73 to 18, and the urban waterlogging inundation area has been reduced from 203.18 hectares to 49.65 hectares.

(iii) Improve the ecological environment of the downstream Liaohe River estuary wetland: Analysis of surface water environmental quality data shows that the downstream of the Liaohe River in Panjin is polluted by sewage overflow during the rainy season. After the rainwater and sewage diversion transformation of this project, urban sewage can be effectively collected to avoid the mixing of sewage and rainwater, thereby reducing overflow, non-point source pollution and other problems. It is expected that the overflow sewage volume can be reduced by 18.0675 million m³/a and the COD emission reduction can be achieved by 4525.8t/a. Reducing the discharge of pollutants will reduce the pollution load on the water environment, help improve the water quality of the downstream Liaohe River estuary, provide a better living environment for aquatic organisms, and promote the improvement of the ecological environment of the Liaohe River estuary wetland.

15.Negative impacts. Although the project will have a positive impact on the ecological and social systems of Panjin City, it may still have certain negative impacts and risks during implementation and operation, which are phased, localized and controllable, and can be minimized through the effective implementation of mitigation measures.

(i) Environmental impacts

16.Potential negative environmental impacts during the construction phase are short-term and localized, related to construction noise, dust, traffic disruption, and worker health, safety and risks. The main risks in the construction stage include:

- i) Construction dust, exhaust gas from construction machinery and transportation vehicles, asphalt fumes;
- ii) The odor impact caused by the demolition of pump stations and the reconstruction of pipelines;
- iii) Temporary noise disturbance from construction machinery and transport vehicles to communities, hospitals and other environmental protection targets;
- iv) Wastewater from concrete maintenance during construction, wastewater from washing construction machinery and vehicles, and surface runoff from rainfall;
- v) Soil and water loss caused by earthwork excavation. According to the preliminary data provided by the FSR, the dredging volume of the project will be 150,014 m³, and the landscaping excavation will be 118,362m³. The dredged earthwork will be used for shoreline consolidation and slope protection, and the earthwork generated by landscaping was used for micro-topography shaping and greening of the sub-project site. There will be no external borrowing or abandoned earthwork in the project.

- vi) Solid wastes include construction waste from pump station demolition and road damage, as well as sludge from pipeline desilting.
- vii) Ecological impact: a) Habitat destruction and change: Land will be directly occupied during the construction of new rainwater and sewage pipes, roads, and the renovation of open channels and culverts, leading to the destruction of original vegetation and surface structure, and loss of some terrestrial habitats. For wetland ecosystems, the renovation of existing wetland landscapes and the improvement of ecological shorelines may change the hydrological conditions of wetlands, such as water level, water flow velocity and water flow direction. If wetland landscape improvement and ecological shoreline transformation projects are carried out during the bird breeding and habitat season, they may directly destroy bird nests and habitats. For example, in wetland landscape improvement areas such as Liaohe Sluice Park and Liaohe Stele Forest Park, if the construction involves trees or grass where birds build nests, birds will lose their breeding places. b) Construction activities such as earth excavation and pipeline laying will seriously disturb the soil, destroy soil structure and soil microbial communities. If effective soil and water conservation measures are not taken during the construction process, such as setting up slope protection, retaining walls and vegetation restoration measures, soil and water loss will easily occur under the influence of factors such as rainfall. c) Ecological connectivity is blocked: Although the project aims to achieve effective connectivity between urban drainage canals, during the construction period, the isolation of the construction area and the obstruction of construction facilities may temporarily hinder the migration and spread of organisms. d) Noise, human activities and mechanical operation during the construction process will disturb birds, affecting their normal foraging, resting and breeding behaviors.
- viii) Domestic waste and domestic sewage generated by construction workers, and occupational health and safety risks associated with construction workers.

17. The contractor will control and reduce emissions through standard procedures, such as (i) setting up fences in the construction site area, sprinkling water regularly, covering dust nets, paying attention to the wind direction when laying asphalt, etc.; (ii) selecting low-noise equipment and reasonably arranging construction time and construction vehicle routes; large-scale machinery and high-noise operations should be avoided in the morning (6:00-8:00) and evening (17:00-19:00) during the peak seasons and times when birds are active, such as the peak seasons of bird breeding and migration (March-May, September-November); and carrying out wetland bird protection and education for workers; (iii) the disturbance of the water environment, benthic organisms and fish caused by construction is temporary and reversible, and will disappear when the construction activities are completed; adopting dry construction methods, strengthening ecological monitoring and management during the construction process, and carrying out ecological restoration work after the construction is completed; (iv) forbidding to pile up construction materials near water body like Pangxiogou River, Yitong River and Liaohe River, forbidding to pile up solid wastes or discharge sewage directly and discharge domestic sewage generated by workers into environmentally friendly toilets, and setting up wastewater sedimentation tanks; (v) Regularly removing domestic garbage, construction spoils, and construction waste etc., recycling pipes, wires, wood, etc., and hiring the third-party units to dispose of hazardous waste, such as waste engine oil, etc.; (vi) Strictly implementing all national laws, regulations and guidelines on work safety, and providing training for all workers on basic sanitation, health and safety issues, including training on gender-based violence and infectious diseases;

18. Operation and Maintenance phase (O&M). During the operation and maintenance (O&M) phase of the project, **potential negative impacts** include noise and vibration generated by the pump station on nearby communities, the impact of foul odors generated by the pump station on nearby communities, pump station grid slag, sludge, waste engine oil, garden waste generated during park and wetland operation and maintenance, road traffic noise, etc. and the disturbance of bird habitats caused by the increase in visitors to the park.

19. During the project operation period, the sewage pump station can effectively control odors by installing cover plates, installing deodorization facilities, and using biological deodorization technology for deodorization; The pump station adopts underground main structure design, effectively reducing the impact of noise on the community; Pump station grid slag, sludge, waste engine oil, and garden waste classification collection and treatment, and garbage recycling facilities are set up to clean up garbage regularly. Bird habitats and aquatic plant population structure are regularly monitored and maintained. Bird science exhibitions are held to publicize bird protection knowledge to the public. Bird habitat buffer zones and bird watching platforms are established and maintained regularly. Flow control mechanisms and non-visit time periods are set up in bird watching areas. Bird-friendly urban facilities are introduced. Low-noise warning signs and visitor guidance facilities are set up. Low-light pollution lamps are installed in wetland and park areas, and directional lighting equipment is used in ecologically sensitive areas.

(ii) Social impacts

20. The negative impacts during the construction period mainly include:

- i) Resettlement impact: The land acquisition of this project affects Shuangtaizi District, Xinglongtai District and Dawa District of Panjin City, affecting a total of 83 households and 244 people. Among them, economic displacement affects 57 households and 175 people (including 46 households and 135 people in non-residential areas), and physical displacement affects 26 households and 69 people.
- ii) Other potential social risks during construction: such as construction vehicles entering and exiting urban residents' work and living areas, temporary traffic restrictions, interference of construction with transportation and other public facilities, and adverse effects of construction waste, dust, noise, etc. on the daily life and travel of community residents.
- iii) Impacts of foreign workers: increased health and hygiene risks, and conflicts between different social and cultural practices.
- iv) Traffic safety impact: including the impact of road closures and traffic congestion, the impact of construction vehicles on road safety, road surface damage and safety risks, and the possibility of traffic accidents caused by them.
- v) The safety hazards of unfinished construction during the flood season can easily lead to urban waterlogging, increase the risk of flood impacts, and affect residents' safety and property.
- vi) Gender impacts: Gender-based violence may arise during the construction process and in daily work on the construction site.
- vii) Impact on cultural relics protection: If any cultural relics or other cultural heritage are discovered during the project construction process, corresponding avoidance and protection measures should be taken in accordance with Article 32 of the Cultural Relics Protection Law of the People's Republic of China.

21. Based on the identified major social impacts during the construction period, corresponding mitigation measures and social management plans have been developed: (i) Measures to reduce land acquisition and demolition risks can be found in the "Resettlement Plan" of this project. (ii) Prior to the commencement of the project, the government will hold meetings with sub-district offices and communities along the project route to coordinate; Publish the construction announcement in the construction section one week in advance, and publicize the project construction information on the project site, news media, municipal group website, official account, community WeChat group, etc.; Simultaneously maintain a smooth channel for project GRM. Ensure that the operations on the construction site comply with the relevant laws and regulations of the People's Republic of China on labor safety, and arrange the construction time reasonably. (iii) Establish a communication platform, strengthen public security management, set up regular communication meetings between construction sites and residents, increase patrol frequency in the construction area and surrounding areas, organize safety training for foreign workers, and enhance their legal awareness. (iv) Reasonably plan the routes of large vehicles and conduct off peak travel; Improve traffic signs, strengthen traffic safety publicity in

construction areas, increase traffic diversion plans, and set up temporary passages. (v) Make solid preparations before the flood season, carry out flood season publicity, and establish flood awareness; Conduct flood prevention training and drills in various forms; Organize relevant personnel to conduct a net like investigation before the flood season. (vi) To guarantee women's labor rights and prioritize providing employment opportunities for female laborers in project areas. (vii) If any cultural relics or other cultural heritage are discovered during the construction process of the project, the following measures shall be taken in accordance with Article 32 of the Cultural Relics Protection Law of the People's Republic of China: a) Immediately stop construction activities; b) Protect the site; c) Immediately report to the local cultural relics administrative department; d) Adjust the construction plan according to the handling opinions of the cultural relics administrative department; e) After the cultural relics administrative department and relevant experts conduct on-site inspections and take appropriate measures, construction will resume.

22. The main negative impacts during the project operation period include:

- i) Post-resettlement impacts: Employment, income and livelihood restoration challenges that resettlement areas may face.
- ii) Traffic safety pressure: If the project operation area is not effectively guided, it may bring new traffic pressure and safety problems.
- iii) Gender impact: During the operation period, there may be some issues regarding the protection of the rights and interests of different gender groups in the project.

23. Based on the identified major social impacts during the operation period, the corresponding mitigation measures and social management plans include: (i) Continuously follow up on the measures and effects of improving income and employment for the affected households in the project area, and pay attention to the economic benefits brought by the project. (ii) Set up reasonable traffic diversion and parking guidance measures; regularly maintain surrounding roads to ensure the safety and smooth flow of road facilities; strengthen traffic monitoring and law enforcement to ensure safety and order. (iii) Establish a gender equality work mechanism to reduce the risk of gender-based violence, increase employment opportunities for women, enhance women's development capabilities, and expand women's participation in decision-making.

E. Climate Change

24. Under the SSP245 (medium forcing scenario) and SSP585 (high forcing scenario), the statistical downscaling model predicts that the future climate will change significantly. **Temperature:** the annual average temperature is expected to continue to rise in the 2050s and 2090s under the SSP245 and SSP585 scenarios, and the temperature increase will continue to increase over time. **Precipitation:** annual precipitation is expected to increase, especially extreme precipitation events will be significantly enhanced, and the maximum daily precipitation in 20 years will increase significantly in different decades and scenarios, indicating that the flood risk faced by the project area will increase significantly. **Drought:** the longest continuous dry days in 20 years are expected to increase in the future, and the risk of extreme drought may increase. **Extreme weather:** the number of high temperature days is expected to increase significantly and the number of cold days is expected to decrease, which means that the risk of heat waves will increase. The main climate adaptation strategies of the project include water system connectivity, optimization of drainage systems, rainwater and sewage diversion, integration of sponge city concepts, construction of intelligent drainage systems, and improvement of government emergency response capabilities.

F. Public Engagement and Information Disclosure

25. Through the construction content, field investigation and interviews, the main stakeholders were identified as residents, vulnerable groups, and people affected by land acquisition and demolition in 17 streets in the three project counties and districts of Panjin City and project-affected people along the project sites; the secondary stakeholders included the Panjin AIB Project Management Office (PMO), project implementation units, relevant government departments, sub-districts, as well as design,

construction, supervision, external monitoring and other units.

26. In the early preparation stage of the project, the FSR preparation unit, the ESIA preparation unit, etc., have carried out information disclosure of the project, including posting notices, reports in provincial mainstream newspapers and Liaoning Daily, and online announcements. With the close cooperation of Panjin AIIB PMO, Panjin Municipal Construction Group (PMCG), Panjin Emergency Management Bureau, Housing and Urban-Rural Development Bureaus of the three districts, county-level/district-level House Expropriation Affairs Center, relevant sub-districts, house owners, communities/village groups and individuals, the ESIA unit carried out various stakeholder participation activities at the project sites in three districts within the scope of the project from July 9 to July 17, 2024, including institutional interviews, field surveys, focus group discussions, interviews with key stakeholders, and questionnaires.

27. The survey found that the daily lives of residents in the project area have been affected and there is an urgent need for engineering projects. Residents hope that the municipal rainwater and sewage pipe network reconstruction and upgrading project will be implemented as soon as possible, as well as improvement of the public infrastructure along the rivers in the urban area of Panjin City and urban landscape. Also, Residents hope to improve and strengthen river management; low-income groups are more enthusiastic and willing to participate in the project; women have a strong willingness to participate that are more acceptable to measures to mitigate the environmental impact of the project; people in the project area have a higher level of awareness of the project; and residents in the project area have a high degree of support for the project.

28. Based on questionnaire surveys, FGDs, in-depth interviews and interviews with key stakeholders, through participatory observation, the information disclosure and public participation plan for this project have been formulated. The project preparation stage includes the basic project information disclosure, site selection willingness survey, design plan participation and consultation, EIA information disclosure and public consultation, land acquisition, construction information disclosure, and the Grievance Redress Mechanism (GRM) disclosure; the project implementation stage includes the reduction of construction impacts, participation in project construction, management of migrant workers, and the GRM disclosure; the project operation stage includes flood control safety and water safety education, road traffic safety knowledge lectures, and the GRM disclosure.

G. Grievance Redress Mechanism

29. Based on the existing GRM in Panjin City, this project will set up the GRM at the project level to collect and handle the concerns and complaints of people, through multiple channels to maximize the E&S benefits of the project. The GRM of this project includes two types: (i) GRM at the project level. Project-affected residents, social groups, and business premises can report problems through the government service hotline 0427-12345 and the WeChat public account for ecological environment complaints. (ii) GRM for project workers. The project implementation unit (PIU) will set up a separate complaint handling center. The PMO, district women's federation, township/sub-district government, village/community women's federation will organize, guide and coordinate the PIU and the project construction unit (contractor) to set up a personnel responsible for the protection of women's rights. Female employees can also report through the Panjin Women's Federation hotline 0427-3380020/12338.

30. Panjin City has established the Panjin AIIB PMO in December 2023. Four staff members from the General Affairs Department of the PMO are responsible for the operation of the GRM. All appeals should be recorded and the relevant personnel should be notified of the entire process of the appeal.

31. In addition, AIIB has established a Project Affected People's Mechanism (PPM). When project-affected peoples believe that they have been or may be adversely affected by the failure to implement the project's environmental and social policies, and their concerns cannot be satisfactorily addressed through the project's GRM or the AIIB's management mechanism, they can resolve the issue through the AIIB PPM. Relevant information about the AIIB PPM can be obtained by visiting the following link:

<https://www.aiib.org/en/about-aiib/who-we-are/project-affected-peoples-mechanism/how-we-assist-you/index.html>.

H.Environmental and Social Management Plan

32. Based on the conclusions of the ESIA, an Environmental and Social Management Plan (ESMP) has been developed for this project. This ESMP includes the establishment of institutions responsible for implementing the plan, their main responsibilities, measures to mitigate environmental and social impacts, timeline for implementation of the measures as well as monitoring arrangements, construction camp management plan, gender action plan, environmental and social monitoring plan, capacity building and training plan, and cost estimates for implementing the ESMP. The ESMP will be part of the bidding documents and contracts for civil engineering contractors.

33. Environmental and social impact mitigation measures. This project covers multiple infrastructure subprojects of different types, such as wetland restoration and conservation project, pipelines, pumping stations, roads, etc. Different subprojects have significant differences in function, nature and construction requirements, and their impacts on the environment and society are also different. For example, wetland construction focuses on the protection and restoration of ecosystems, and pays attention to the impact on biodiversity such as birds; the main impact of road construction is concentrated on traffic interference, noise and dust during construction. By setting up a general and subproject specific mitigation measures table, different impacts can be responded to more comprehensively and specifically, and precise management can be achieved.

(i) General mitigation measures.

34. Design and construction preparation stage: general mitigation measures include updating the ESIA and ESMP, incorporating environmental and social mitigation measures into project design, standardizing bidding documents and contracts, clarifying environmental management organizations, hiring external monitoring units, conducting project management consulting, training project staff, establishing a GRM, project information disclosure, formulating a stakeholder engagement plan, and preparing site ESMP and avoiding conflicts due to land acquisition and demolition. These measures are applicable to all sub-projects of the project and provide a comprehensive environmental and social management basis for the overall planning and launch of the project.

35. Construction period: measures involve air pollution, sewage, construction waste and domestic waste treatment, noise pollution control, soil erosion prevention and control, cultural heritage protection, resettlement and land acquisition and demolition management, worker and community safety, infectious disease prevention, traffic interference mitigation, stakeholder participation promotion, labor and working conditions standardization, reducing the impact on local enterprises and employees, avoiding community conflicts, dealing with public facilities and service interference, flood season construction risk prevention and control, attracting local labor participation and related enterprises to provide employment opportunities, etc. These general measures ensure that during the construction process, each subproject can comply with basic environmental and social management requirements, reduce the negative impact of construction activities on the environment and society, and ensure the smooth progress of construction and the rights and interests of stakeholders.

36. Operation period: General measures have been formulated in environmental management aspects such as water pollution control, solid waste treatment, noise control, air pollution prevention and control, as well as social management aspects such as employment protection for vulnerable groups, community environmental risk response, establishment of public consultation mechanism, traffic safety risk prevention and control, and job opportunities.

(ii) Specific mitigation measures for subprojects

37. Applicable to Component 1 (wetland restoration and conservation project):

38. Design and construction preparation stage: In order to protect biodiversity such as wetland birds, measures such as habitat planning and protection, tree species and vegetation layout, water system design and habitat protection, isolation of habitats from tourist paths, habitat lighting control, noise isolation design, water quality management facilities, landscape design and bird protection, and environmental education facility design have been formulated.

39. Construction period: specific measures have been formulated in terms of water protection, noise control, habitat protection, waste management, personnel training and bird monitoring. For example, sedimentation tanks and isolation facilities will be set up to prevent construction wastewater from

polluting water bodies, construction is avoided during sensitive periods and noise reduction measures will be taken, the construction scope will be controlled to protect habitats, waste management will be standardized to avoid pollution of wetlands, construction personnel will be trained in wetland ecological protection, and bird observation points will be established for monitoring.

40. Operation period: specific measures have been formulated including regular inspections of bird habitats, public science exhibitions and bird watching guidance, establishment of ecological buffer zones and bird watching platforms, maintenance of ecological habitat islands, management of aquatic plant population structure, maintenance of bird watching platforms and buffer zones, management of solid waste, introduction of bird-friendly urban facilities, control of noise and light pollution, etc. These measures are aimed at protecting the ecological environment of wetlands and parks, raising public awareness of wetland protection, and ensuring tourists' experience and the quality of life of surrounding residents during the operation of the wetland project.

41. Applicable to component 2 (sponge city infrastructure transformation project):

42. Operation period: Specific measures have been formulated mainly for water pollution, solid waste treatment, noise control and air pollution during the operation of the pump station. For example, the management and inspection of the pipe network operation will be strengthened, inspection wells and accident emergency pools will be set up, domestic garbage, grille residue and sludge generated by the pump station will be handled, low-noise equipment will be selected and sound insulation measures will be taken, odor emission will be controlled, etc., to reduce the adverse impact on the surrounding environment and residents.

43. **Institutional arrangements for the implementation of the ESMP.** The project is implemented by the Panjin Municipal People's Government, and a special working group and a special working group office have been established to supervise and guide the project. Panjin Municipal Construction Group Co., Ltd. (hereinafter referred to as "PMCG"), as the project implementation unit (PIU), is the environmental and social responsible entity of the project, ensuring that all project activities comply with national and local environmental and social laws and regulations and the environmental and social policy requirements of the AIIB. The contractor is responsible for the implementation of environmental and social mitigation measures during the construction process. The supervision company supervises the contractor's implementation of mitigation measures and submits monitoring reports regularly. The external monitoring unit conducts independent monitoring and evaluation of the project implementation effect every six months.

44. **Monitoring and Reporting.** The ESMP incorporates internal and external monitoring. Internal monitoring is carried out by the PMO and the PIU, and the environmental and social monitoring report is submitted to the AIIB every six months as an attachment to the project progress report. The monitoring report includes (i) progress in the implementation of the environmental and social implementation plan and corrective measures; (ii) compliance with the implementation of the ESMP; (iii) environmental and social monitoring results; (iv) institutional strengthening and training; (v) stakeholder participation; (vi) operation of the GRM; (vii) labor statistics; and (viii) corrective measures. The construction supervision company will conduct internal environmental, health and safety monitoring of the construction site and report the monitoring results to the project implementation unit through monthly progress reports. External monitoring will be carried out by hiring a local qualified environmental testing agency to prepare an environmental monitoring and evaluation report, resettlement and social monitoring and evaluation report, and submit both Chinese and English versions to the project implementation unit and the AIIB every six months.

45. **Estimated cost of implementing the ESMP.** The total estimated cost of implementing the environmental and social management plan project is approximately RMB 22.34 million (excluding the cost of resettlement of state-owned farm employees), including environmental protection and safety and civilized construction measures during the construction period, environmental and social external monitoring fees, capacity building costs, etc.

I. Conclusion

46. This Project aims to adapt to climate change, enhance the climate resilience capacity of the Panjin City, reconstruct the drainage pattern, protect wetland ecology, implement the sponge city concept,

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address the urban waterlogging issue, achieve energy conservation and emission reduction, and improve the level of digital management. Under the precondition of implementing all measures outlined in this ESMP, the project is feasible from the perspective of environmental and social risk management.

1 Introduction

1.1 Project Description

1. Liaoning Panjin Urban Climate Resilience with Nature Based Approaches for Sustainable Municipal Service Infrastructure (hereinafter referred to as "the Project") covers the main urban areas of Panjin City, Liaoning Province, including Shuangtaizi District, Xinglongtai District, High-tech Zone and Dawa District, and the project scope does not involve natural reserves, important wetlands and ecological red lines.

2. This Project aims to adapt to climate change, enhance the climate resilience capacity of the Panjin City, reconstruct the drainage pattern, protect wetland ecology, implement the sponge city concept, address the urban waterlogging issue, achieve energy conservation and emission reduction, and improve the level of digital management. It involves four components: (i) wetland restoration and conservation, (ii) sponge city infrastructure transformation, (iii) digitalization of urban drainage management system, (iv) capacity building;

3. Component 1: Wetland restoration and conservation. This component includes renovation of 21 urban green spaces and 133,028 square meters of sponge squares. It includes: (i) 5 urban drainage canals connection subprojects such as the Yijiang Road drainage connection subproject; (ii) 4 wetland restoration subprojects such as the Liaohe Steles Park Wetland Ecological Restoration and Improvement Project; (iii) 5 ecological shoreline subprojects such as the North Drainage Slope protection subproject; (iv) Shuangtaizi District and Xinglongtai District Urban Ecological Green Island subprojects.

4. Component 2: Sponge city infrastructure transformation. This component includes 16 stormwater and sewage pipelines projects including the main roads in Dawa District, constructing 93.4 km of new stormwater pipelines, 41.2 km of new sewage pipelines; 2 projects of new pump station construction including Zhuanglin pump station; 3 pump station equipment upgrading projects including Xinglongtai District project, Shuangtaizi District project and Dawa District project. Component 2 includes 22 projects in total, involving construction of 8 new pump station, reconstruction of 3 pump station and replacing equipment for 46 drainage pump stations.

5. Component 3: Digitalization of urban drainage management system. This component includes digitalization of urban drainage management system, integration of management of drainage facility assets and drainage household information, and construction of drainage facility three-dimensional visualization, grid-based inspection and maintenance, dynamic operation monitoring and early warning, and joint dispatch modules.

6. Component 4: Capacity building. This component will establish and hire a project implementation management team to assist the project management office (PMO) and PIU to manage projects in accordance with AIIB policies and rules; technical training for management personnel and technical personnel and management personnel of stakeholders on AIIB policies and related fields will be carried out; In addition, field visits and study in domestic demonstration projects or demonstration cities and pilot cities will be provided. This component will enhance the management and technical service capabilities of management personnel and technical personnel of relevant stakeholders.

7. The project implementing agency is Panjin Municipal Construction Group Co., Ltd (PMCG). The implementation period of this project is from December 2025 to December 2030, a total of 60 months.

1.2 Purpose of Environmental and Social Impact Assessment

8. The scope of the Panjin project is the urban area of Panjin City, which does not involve international important wetlands or natural reserves. The wetlands involved in the Component 1 are urban wetland parks or green spaces on both sides of canals, where human activities are frequent. However, the project scope is relatively wide, and land acquisition and demolition involve Shuangtaizi District, Xinglongtai District and Dawa District, affecting a total of 83 households and 244 people. Among them, the impact of economic displacement is 57 households and 175 people (including 46 non-residential households and 135 people), and physical displacement is 26 households and 69 people. 28.5 mu of collective land will be permanently acquired, affecting 50 households and 153 people; 204.29 mu of

state-owned farm land will be permanently occupied, affecting 31 households and 86 people (among them, houses in 10 mu of state-owned constructive land will be demolished, affecting 22 households and 51 people; 9 households and 35 people will be affected by permanent occupation of state-owned farm land) ; 5 mu of collective land will be temporarily occupied, affecting 2 households and 5 people; 16,134 m² of houses will be demolished, affecting 72 households and 204 people (Among them, 153 people in 50 households will be affected by both LA and HD). The resettlement impact of this project is mostly linear projects, and most of them are expansion and reconstruction on the basis of original buildings, so the impact of land acquisition on each affected household is small. According to the ESF of AIIB, this project has prepared a resettlement plan. According to the ESP of AIIB, the Project is categorized as a Category A project for the environment and society that the project may have significant impacts on the environment and society. As the result the project needs to be carried out comprehensive environmental and social impact assessment.

9. This environmental and social impact assessment aims to (i) identify and analyze the potential direct, indirect and cumulative environmental and social risks and impacts of the project during the construction and operation phases to ensure that all possible risks and impacts are fully identified and managed; (ii) to Apply the mitigation hierarchy to identify measures to avoid, eliminate, reduce or offset potential adverse risks and impacts to the environment, affected communities and Labor; (iii) to assess the differences between relevant domestic and AIIB environmental and social policies to ensure that the project simultaneously meets the requirements of AIIB ESP and relevant domestic environmental and social policies and regulations; (iv) to formulate environmental and social management plans (ESMP), make effective use of the management system, support the integration of environmental and social management measures with project design and implementation, and enhance and expand the environmental and social performance of this project; (v) specify the implementation procedures, institutional arrangements, capacity enhancement, monitoring and reporting requirements of the project; (vi) to Establish a grievance redress mechanism (GRM) to ensure that the complaints of project-affected people, affected communities and other stakeholders are responded to and managed; (vii) to Promote the participation of stakeholders, especially project-affected people, and ensure the disclosure and dissemination of environmental and social information related to the project, including project design, mitigation and monitoring measures, environmental and social benefits of the project, and project implementation issues.

10. Therefore, PMCG entrusted China Urban Construction and Design Research Institute Co., Ltd. (CUCD) to undertake the preparation of the ESIA and ESMP of this project.

1.3 Methods of Environmental and Social Impact Assessment

11. This ESIA is developed based on relevant domestic environmental and social laws, regulations, policies, technical guidelines, and the environmental and social framework of the AIIB, and has carried out in combination with the engineering characteristics of the project and the environmental characteristics along the route to ensure the accuracy and comprehensiveness of the assessment. The specific assessment methods are as follows:

(i) **Desk review.** The ESIA compilation team consulted AIIB's ESP and ES Standards, the laws and regulations related to the project, the policies related to economic development and environmental protection of Liaoning Province and Panjin City, Territory Spatial Planning of Panjin City, Urban Master Planning of Panjin City, Wetland Protection Master Planning and other planning, the environmental and social status of Panjin City, the ecological environmental monitoring data of Panjin City, the statistical yearbook, and the feasibility study reports (FSR), and other documents. The gaps between the domestic environmental social assessment and AIIB's requirements were identified and developed an assessment work plan, based on a study of the domestic environmental social assessment report and an understanding of AIIB's ESP requirements. The main reviewed technical materials are as follows:

- AIIB Environment and Social Policy (Revised in 2024)¹
- "Feasibility Study Report for the Liaoning Panjin Urban Climate Resilience with Nature Based Approaches for Sustainable Municipal Service Infrastructure" (October 2024);

¹ <https://www.aiib.org/en/policies-strategies/framework-agreements/environmental-social-framework.html>

- "Panjin Environment Quality Bulletin 2020"², "Notice of the Panjin Municipal People's Government on Issuing the Panjin Urban Area Acoustic Environment Functional Zoning Plan"³, etc.
- (ii) **Field survey.** During July 2024, the environmental and social impact assessment investigation team (ESIA unit) conducted an on-site investigation and surveyed the proposed construction sites, aiming to understand the site selection, land status, sensitive points, influencing factors, resident composition and needs of each project area, as well as the socio-economic living conditions of the project-affected people in the project area. The scope of the on-site investigation includes the proposed project sites and surrounding areas of the Xinglongtai District, Shuangtaizi District, and Dawa District. The key research contents were the natural environment and vegetation status around the proposed wetlands, the surrounding environment of the proposed drainage facilities, the surrounding environment of the project-affected communities, and determining the distribution of project-affected communities combined with using satellite maps. On-site surveys can intuitively understand and grasp the conditions of the site and the surrounding environment, identify environmental problems timely and provide strong evidence for the preparation of EIA.
- (iii) **On-site focus group discussion (FGD).** The ESIA unit conducted 18 resident focus group discussions (FGD) in towns and sub-districts in the project area, with a total of 312 participants. Among them, 91 were women, accounting for 29.17%; 56 elderly people, accounting for 17.95%; 153 project department heads, neighborhood committees, and village representatives, accounting for 50.4%. At the FGD, the ESIA unit, through direct dialogue with the project-affected people, collected information on the current situation of social development and the production and life of local people, understood the views and needs of local people on the project, and listened to their suggestions. The team has conducted 48 institutional interviews and discussions with the Special class office for Liaoning Panjin Urban Climate Resilience with Nature Based Approaches for Sustainable Municipal Service Infrastructure (that is, the project organization unit, Hereinafter referred to as "Panjin AIIB PMO"), Panjin Municipal Construction Group Co., LTD. (PMCG) (that is, the PIU), country-level House Expropriation Affair Center, Natural Resources and Planning Bureau, Ecological Environment Bureau, Statistics Bureau, Human Resources and Social Security Bureau (Labor Protection Bureau), Rural Revitalization Bureau, Civil Affairs Committee, Women's Federation, Civil Affairs Bureau, Environmental Protection Bureau, Transportation Authority and other agencies and departments and collected basic data and literature closely related to the project.
- (iv) **Questionnaire Survey.** The ESIA compilation team designed a set of environmental and social questionnaires based on the characteristics of the project. The survey questions include but are not limited to the possible impacts of the project on the environment, public expectations for the project, etc. and the survey objects were the identified stakeholders in two sub-project areas. Using probability and scale proportional sampling (PPS sampling) method, a total of 500 one-on-one face-to-face questionnaire surveys were completed in three project counties and districts. After statistical testing and screening, 500 valid questionnaires were obtained, with a questionnaire effectiveness rate of 100%. Using the questionnaires survey, the ESIA compilation team can collect public opinions and requirements on the project, understand the current social situation, collect statistics on issues that local people are concerned about during project construction and operation, and improve the quality of ESIA with the help of public judgment.
- (v) **Individual interviews.** Although the project construction has positive impacts on the local social and economic development as a whole, the impact on individuals may be quite different. For this reason, based on the interviews on the FGD, the ESIA team also conducted individual in-depth interviews by selecting some people who are greatly affected by the project, to understand their views and suggestions on the project construction in a more specific and in-depth manner. The environmental and social impact assessment survey team conducted interviews with key informants at the county, township, subdistrict, and village/community levels of the project, mainly targeting 58 key informants from three counties and districts, including 20 from Xinglongtai District; 20 people in Shuangtaizi District; 18 people in Dawa District. To gain a more comprehensive understanding of

² People's Government of Panjin (April 17 2023). -Panjin Environment Equality Bulletin 2020.

³ People's Government of Panjin (February 17 2023). Notice of the Panjin Municipal People's Government on Issuing the Panjin Urban Area Acoustic Environment Functional Zoning Plan.

stakeholders' attitudes towards the project and provide better recommendations for project design and implementation.

- (vi) **Compilation of the preliminary draft:** Based on the in-depth analysis of the project, combined with the opinions and suggestions collected at the FGD, and the detailed data of the field survey, the ESIA team carried out a comprehensive environmental and social impact assessment in accordance with relevant technical guidelines and assessment methods, and prepared the preliminary draft of ESIA and ESMP.
- (vii) **Public and stakeholder’s consultation:** The preliminary draft of ESIA and ESMP shall be consulted by the public, experts, PIUs and the AIIB, to ensure that the assessment is more comprehensive and accurate and fully reflects the demands of different stakeholders.

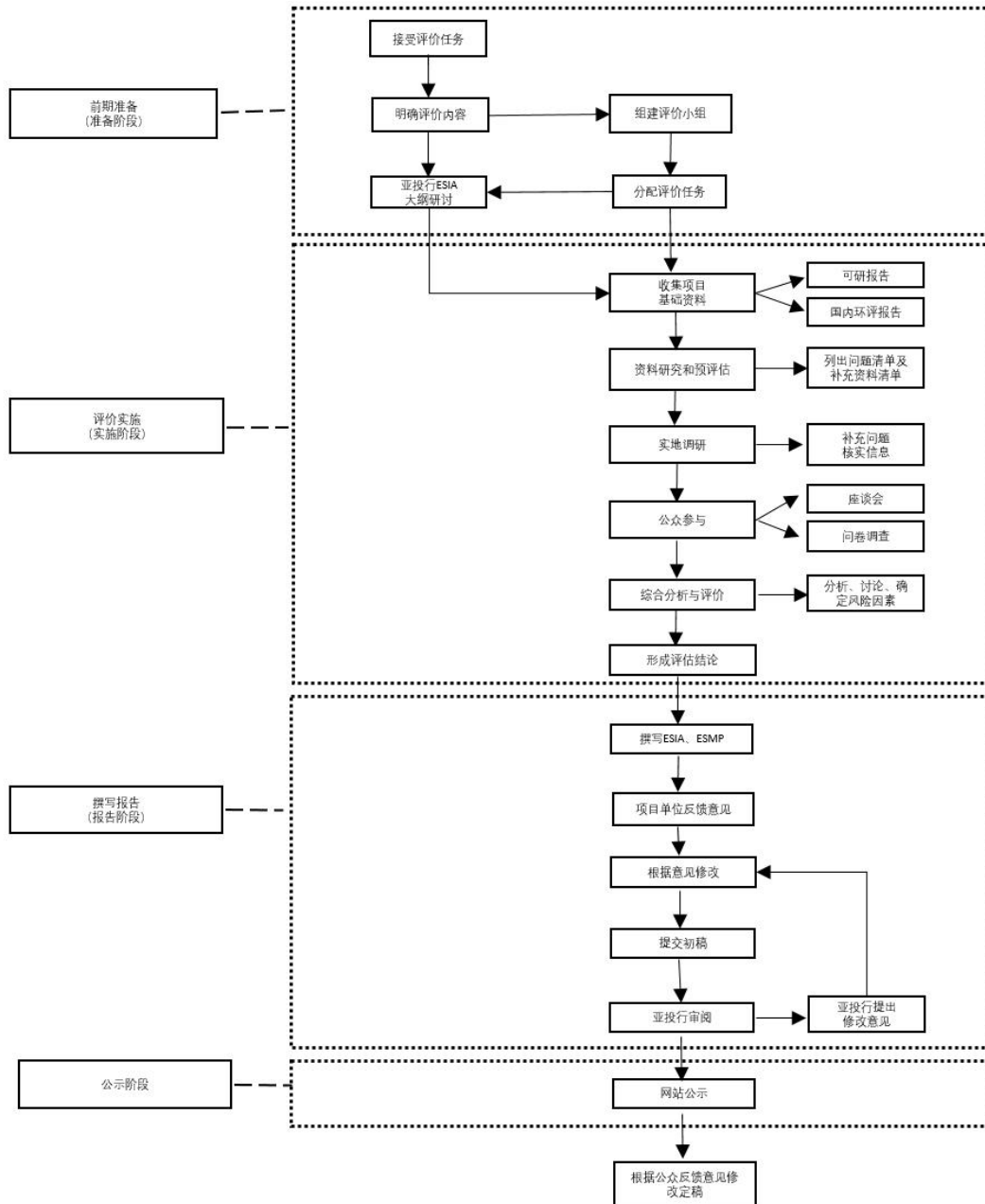


Figure 1-1 Technical Framework of Environmental and social assessment

1.4 Structure of the report

12.This ESIA report has been prepared as per requirements of the AIIB’s Environmental and Social

Framework. The report will be organized into the following chapters, a brief of each chapter is described below:

Executive Summary

Chapter 1 Introduction: This chapter includes project brief description, the purpose of ESIA, the research method of ESIA and the structure of the report.

Chapter 2 Policy, Legal and Administrative Framework: This chapter discusses the national laws applicable to the project, the applicable AIB ESMP, environmental and social standards (ESSs), and compares the differences between the domestic environmental and social management system with the AIB ESSs.

Chapter 3 Project Description: This chapter presents the project background, construction goals, construction period, project description, and identification of existing and associated facilities.

Chapter 4 Alternatives Comparison and Selection: This chapter discusses the mandatory selection of project technical solutions and non-project alternatives, and presents the benefits after project implementation.

Chapter 5 Environmental and Social Baseline Data: This chapter presents the relevant geography, environmental quality, ecology, land use, economic development and social status in the project area.

Chapter 6 Environmental Impact and Risk Analysis and Mitigation Measures: This chapter predicts and evaluates the potential positive and negative environmental impacts during both the construction and operational phases of the project. It discusses corresponding mitigation measures and addresses potential climate risks that the project facilities may face, as well as measures to enhance climate resilience and adaptability.

Chapter 7 Social Impact Analysis: This chapter predicts and evaluates the potential positive and negative social impacts, including those on vulnerable groups and gender, during the pre-construction, construction, and operational phases of the project. It discusses corresponding mitigation measures.

Chapter 8 Stakeholder Engagement: This chapter identifies the main stakeholders and secondary stakeholders, and conducts the stakeholder demand analysis, describes the risk impacts of project construction and operation on labor rights, occupational safety and health environment, and discusses the corresponding mitigation measures.

Chapter 9 Public Consultation and Information Disclosure: This chapter describes methods of information disclosure, finished information disclosure and consultations.

Chapter 10 Grievance Redress Mechanism: This chapter describes the established grievance redress mechanism (GRM) for project-affected people, and GRM for workers, and corresponding record and feedback mechanism.

Chapter 11 Community, Occupational Safety and Health: This chapter analyses describes the potential risks on community, occupational safety and health, and describes management measures and labor right safeguard measures.

Chapter 12 Environmental and Social Management Plan: This chapter discusses a series of mitigation and management measures that should be taken during project implementation to avoid, reduce, minimize, or compensate adverse environmental and social impacts; describes relevant organizations, responsibility arrangements, capacity development and training plans to adapt the implementation of ESMP; as well as presents environmental and social monitoring and reporting requirements.

Chapter 13 Conclusions

2 Policy, Legal and Administrative Framework

13. The preparation of this report complies with the current applicable environmental and social laws and regulations of the People's Republic of China, local and departmental regulations, technical guidelines and specifications of Liaoning Province and Panjin City, and the requirements of the AIIB's "Environmental and Social Framework" (revised in 2024).

2.1 Applicable National Environmental Laws and Regulations

14. This section introduces China's environmental protection laws and regulations and China's social laws, policies and plans that are relevant and applicable to this project.

2.1.1 Environmental Laws and Administrative Regulations

(i) "Environmental Protection Law of the People's Republic of China" (revised on April 24, 2014)

15. The "Environmental Protection Law of the People's Republic of China" stipulates the basic principles and basic systems of environmental protection, and is a basic and comprehensive law in the field of environmental protection.

(ii) "Environmental Impact Assessment Law of the People's Republic of China" (2016.7.2 Amendment)

16. Article 16 China implements classified management of environmental impact assessment of construction projects according to the degree of impact of construction projects on the environment.

17. Construction units shall organize and prepare environmental impact reports, environmental impact report forms or fill in environmental impact registration forms (hereinafter collectively referred to as EIA documents) in accordance with the following provisions:

18. (i) If it may cause major environmental impact, an environmental impact report shall be prepared to conduct a comprehensive assessment of the environmental impact;

19. (ii) If it may cause minor environmental impact, an environmental impact report form shall be prepared to analyze or specifically evaluate the environmental impact;

20. (iii) If the environmental impact is very small and no environmental impact assessment is required, an environmental impact registration form shall be filled in.

21. Article 25 If the EIA documents of a construction project have not been reviewed by the approval department in accordance with the law or have not been approved after review, the construction unit shall not start construction.

22. This project needs to complete the domestic EIA procedures before starting construction.

(iii) "Environmental Noise Pollution Prevention and Control Law of the People's Republic of China" (2018 Amendment)

23. Article 13 Construction projects for new construction, reconstruction and expansion must abide by the state's regulations on environmental protection management of construction projects.

24. If the construction project may cause noise pollution, the construction unit shall, in accordance with regulations, submit an environmental impact report specifying the measures for the prevention and control of environmental noise pollution, and report to the environmental protection administrative department following the national procedures.

(iv) "Land Administration Law of the People's Republic of China" (effective from January 1, 2020)

25. Article 4 The state implements a land use control system. The state formulates an overall plan for land use, stipulates land use, and divides land into agricultural land, construction land, and unused land. Strictly restrict the transformation of agricultural land into construction land, control the total amount of

construction land, and implement special protection for cultivated land.

(v) "Water Pollution Prevention and Control Law of the People's Republic of China" (revised in 2017)

26. Article 4 People's governments at or above the county level shall incorporate water environment protection into their national economic and social development plans. Local people's governments at various levels are responsible for the quality of the water environment in their administrative regions and shall take timely measures to prevent and control water pollution.

(vi) "Law of the People's Republic of China on the Protection of Cultural Relics" (revised in 2015)

27. Article 19 Within the protection scope and construction control zone of a cultural relics protection unit, no facilities that pollute the cultural relics protection unit and its environment shall be constructed, and activities that may affect the safety of the cultural relics protection unit and its environment shall not be carried out. Existing facilities that pollute cultural relics protection units and their environment should be dealt with within a time limit.

(vii) Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste (revised in 2020)

28. Article 17 Construction projects that generate, store, utilize, and dispose of solid waste shall conduct environmental impact assessments in accordance with the law and abide by the state's regulations on environmental protection management of construction projects.

(viii) "Law of the People's Republic of China on the Prevention and Control of Air Pollution" (revised in 2018)

29. Article 2 The prevention and control of air pollution shall aim at improving the quality of the air environment, adhere to source control, plan first, transform the mode of economic development, optimize the industrial structure and layout, and adjust the energy structure.

30. To prevent and control air pollution, we should strengthen the comprehensive prevention and control of air pollution from coal burning, industry, motor vehicles and ships, flying dust, agriculture, etc., promote joint prevention and control of regional air pollution, and control air pollutants such as particulate matter, sulfur dioxide, nitrogen oxides, volatile organic compounds, ammonia, as well as greenhouse gases.

(ix) Regulations on Urban Drainage and Sewage Treatment (effective January 1, 2014)

31. Article 2 This Regulation shall apply to the planning of urban drainage and sewage treatment, the construction, maintenance and protection of urban drainage and sewage treatment facilities, the drainage and sewage treatment to urban drainage facilities, and the prevention and control of urban waterlogging.

32. Article 13 Local people's governments at or above the county level shall, in accordance with urban drainage requirements and in combination with the nature and conditions of urban land use, strengthen the construction and renovation of stormwater pipe networks, pumping stations, and rainwater storage and discharge facilities for rainwater runoff that exceeds standards.

33. New construction, reconstruction and expansion of municipal infrastructure projects should construct stormwater collection and utilization facilities, increase the stormwater infiltration capacity of green spaces, gravel surfaces, permeable roads and natural land, use buildings, parking lots, squares, roads, etc. to build stormwater collection and utilization facilities, reduce stormwater runoff and improve the ability to prevent and control urban waterlogging.

34. The construction of new areas and the reconstruction of old urban areas should construct relevant facilities in accordance with the stormwater runoff control requirements determined by the urban drainage and sewage treatment plan.

35. Article 19 Except for arid areas, new district construction shall implement stormwater and sewage diversion; in areas where stormwater and sewage are combined, stormwater and sewage diversion transformation shall be carried out in accordance with the requirements of urban drainage and sewage treatment planning. Stormwater and sewage diversion transformation can be carried out simultaneously with the reconstruction of old urban areas and road construction.

(x) Regulations on the administration of environmental protection of construction projects (implemented on July 16, 2017)

36. Article 6 The state implements an environmental impact assessment system for construction projects.

37. Article 15 The supporting environmental protection facilities required by the construction project must be designed, constructed and put into operation at the same time as the main project.

(xi) "Category Management Directory of Environmental Impact Assessment of Construction Projects" (2021 Edition)

38. The Directory specifies environmentally sensitive areas, classifies the environmental impact assessment report category of construction projects according to the category of construction projects, and determines whether the construction project should prepare an environmental impact report, environmental impact report form or environmental impact registration form; the construction unit should strictly follow this directory to determine the construction project. The category of environmental impact assessment shall not be changed without authorization.

39. The proposed drainage pump station for this project belongs to the 51st category: Water Conservancy-Flood Drainage and Waterlogging Removal Project, and an environmental impact registration form needs to be filled in. Urban drainage canals connectivity and shoreline improvement belong to the 51st category: Water Conservancy-River and Lake Improvement, and an EIA report needs to be prepared. Newly rainwater and sewage pipes and roads construction and renovation belong to the 52nd category: Transportation and pipeline transportation-urban (town) pipeline network and pipeline corridor construction, and an environmental impact registration form needs to be filled in. The environmental impact registration form will be submitted to the county-level environmental protection administrative department where the construction project is located for the record.

40. Before the construction of the project, the environmental impact assessment report form shall be prepared by an environmental assessment unit hired by PMCG and submitted to the competent environmental protection administrative department with the power of examination and approval, the Panjin Ecological Environment Bureau for approval. Where the environmental impact assessment documents of a construction project have not been examined by the examination and approval department according to law or are approved after examination, the construction unit shall not start construction. Panjin Municipal Bureau of Ecology and Environment will make an approval decision and notify the construction unit in writing within 30 days after receiving the environmental impact report form. After the EIA report of the construction project is approved, the information will be disclosed on the official website of Panjin Municipal Bureau of Ecology and Environment. It is expected to complete the domestic EIA approval process by October 2025.

(xii) "Industrial Structure Adjustment Guidance Catalog (2021)"

41. The catalog covers more than 20 industries, of which 539 are encouraged, 190 are restricted, and 399 are eliminated.

(xiii) Wetland Protection Law of the People's Republic of China (June 2022)

42. Article 28 The following acts of damaging wetlands and their ecological functions are prohibited:

i) Opening (enclosing) reclamation and draining natural wetlands, and permanently cutting off the water source of natural wetlands;

ii) Unauthorized landfilling of natural wetlands, unauthorized sand mining, mining, and soil extraction;

iii) Discharging industrial waste water, domestic sewage and other waste water and sewage polluting wetlands that do not meet the water pollutant discharge standards, dumping, stacking, discarding, and scattering solid waste;

iv) Overgrazing or overharvesting of wild plants, overfishing or extinct fishing, excessive fertilization, dosing of pesticides, feeding of bait, and other planting and breeding behaviors that pollute wetlands;

v) Other behaviors that damage wetlands and their ecological functions.

(xiv) Energy Conservation Law of the People's Republic of China (2020 Amendment)

43. Article 15 The state implements a system of energy conservation assessment and review for fixed asset investment projects.

44. Article 35 Construction, design, construction and supervision units of construction projects shall abide by building energy conservation standards.

2.1.2 Environmental departmental regulations and other normative documents

- (i). "Notice on Printing and Distributing the "14th Five-Year" Noise Pollution Prevention and Control Action Plan" (Huandaqi [2023] No.1);
- (ii). "Regulations for the Implementation of the Cultural Relics Protection Law of the People's Republic of China" (2003.7);
- (iii). "Notice of the State Council on Printing and Distributing the Action Plan for Water Pollution Prevention and Control" (State Council, Guofa [2015] No.17, 2015.4.2);
- (iv). "Opinions of the Central Committee of the Communist Party of China and the State Council on Accelerating the Construction of Ecological Civilization" (Central Committee of the Communist Party of China, State Council, 2015.4.25);
- (v). "Notice of the State Council on Printing and Distributing the Action Plan for Soil Pollution Prevention and Control" (State Council, Guofa [2016] No.31, 2016.5.28);
- (vi). Circular of the State Council on the Issuance of the 14th Five-Year Plan for Ecological Protection and Supervision (Ministry of Ecology and Environment, Environment and Ecology [2022] No.15, 2022.3.18)
- (vii). "Decision of the State Council on the Implementation of the "National Overall Emergency Response Plan for Public Emergencies" (State Council, Guofa [2005] No.11, 2005.4.17);
- (viii). "Interim Measures for the Management of Emergency Plans for Environmental Emergencies" (Ministry of Environmental Protection³, Huanfa [2010] No.113, 2010.9.28);
- (ix). "Guiding Opinions on Strengthening the Prevention and Control of Environmental Noise Pollution to Improve the Quality of Urban and Rural Acoustic Environment" (Ministry of Environmental Protection, Huan Fa [2010] No.144, 2010.12.15);
- (x). "Notice on Further Strengthening Environmental Impact Assessment Management to Prevent Environmental Risks" (Ministry of Environmental Protection, Huan Fa [2012] No.77, 2012.7.3);
- (xi). "Notice on Effectively Strengthening Risk Prevention and Strict Environmental Impact Assessment Management" (Ministry of Environmental Protection, Huan Fa [2012] No.98, 2012.8.7);
- (xii). "Notice on Strengthening Environmental Impact Assessment Management with Improving Environmental Quality as the Core" (Ministry of Environmental Protection, EIA [2016] No.150, 2016.10.26);
- (xiii). "Wetland Protection Management Regulations" (State Forestry Administration, Order No.32, 2013.3.28);
- (xiv). "Notice on Implementing Air Pollution Prevention and Control Action Plan and Strictly Enabling Environmental Impact Assessment Access" (General Office of the Ministry of Environmental Protection, Huanban [2014] No.30, 2014.3.25);

2.1.3 Local laws and regulations

- (i). "Liaoning Provincial Environmental Protection Regulations" (Implemented on February 1,

³ Ministry of Ecology and Environment of the People's Republic of China

- 2018);
- (ii). "Liaoning Province Water Pollution Prevention and Control Regulations" (Implemented on February 1, 2019);
 - (iii). "Measures for the Prevention and Control of Environmental Pollution by Solid Waste in Liaoning Province" (Revised in 2013);
 - (iv). "Notice of Liaoning Provincial People's Government on Action Plan for Pollution Prevention and Ecological Construction and Protection in Liaoning Province (2017-2020)" (implemented on April 25, 2017);
 - (v). "Dust Emission Standards for Construction and Stacking Sites in Liaoning Province" (DB21/2642-2016);
 - (vi). "Opinions of the People's Government of Yingkou City on the Implementation of the "Three Lines and One List" Ecological Environment Zoning Management and Control" (Yingzhengfa [2021] No.2);
 - (vii). "Notice of Yingkou Municipal People's Government on Printing and Distributing Yingkou City's Three-Year Action Plan for Winning the Blue Sky Defense War (2018-2020)" (Yingzhengfa [2019] No.6);
 - (viii). "Opinions of the Panjin Municipal People's Government on the Implementation of the "Three Lines and One List" Ecological Environment Zoning Control" (Panjin Government [2021] No.9);
 - (ix). "Notice of the Panjin Municipal People's Government on Issuing the Panjin City Action Plan to Win the Blue Sky Defense War" (Panjin Government [2019] No.14);
 - (x). "Notice of the Panjin Municipal People's Government on Issuing the Panjin Urban Area Acoustic Environment Functional Zoning Plan" (Panjin Government [20 22] No.18)
 - (xi). "Panjin City National Land Space Master Plan (2021-2035) (Draft)"
 - (xii). "Panjin City Master Plan (2011-2020)"
 - (xiii). "Notice of the Panjin Municipal People's Government Office on Issuing the Panjin City Three-Year Action Plan for Comprehensively Implementing the River Chief System and River and Lake Management and Protection (2018-2020)" (Panjin Government Office [2018] No.57);
 - (xiv). "Notice of the Panjin Municipal People's Government on Issuing the Panjin Municipal Water Pollution Prevention and Control Work Plan" (Panjin Government [2016] No.13);
 - (xv). "Opinions of the Panjin Municipal People's Government Office on Further Strengthening the Comprehensive Improvement of River Environment" (Panjin Government Office Notice [2019] No.35);
 - (xvi). "Notice of the Office of the People's Government of Shuangtaizi District, Panjin City on Issuing the Work Plan for Rectification of Water Quality Standards for Regional River Sections in Shuangtaizi District in 2020" (Shuangqu Zhengbanfa [2020] No.11);
 - (xvii). "Notice on Implementing the Interim Measures for the Examination and Management of the Total Discharge Index of Major Pollutants in Construction Projects of the Ministry of Environmental Protection" (Liaohuanfa [2015] No.17)

2.1.4 Environmental Related International Conventions

45. The international conventions related to this project that China has signed or signed mainly include:

- Vienna Convention for the Protection of the Ozone Layer (22 March 1985);
- Amended Montreal Protocol on Substances that Deplete the Ozone Layer (16 September 1987);

- Convention on Biological Diversity (joined on 5 January 1993);

- Convention on Wetlands of International Importance (joined on July 31, 1992), also known as the Ramsar Convention. The Liaohe Estuary Wetland in Panjin was listed in the List of Internationally Important Wetlands in 2004. **International Wetland City** is an international honor awarded by the Convention on Wetlands of International Importance to recognize cities that have made outstanding achievements in wetland protection and sustainable development. These cities need to meet multiple strict standards, including wetland protection and management, legal and policy guarantees, community participation, sustainable utilization, wetland ecological monitoring and capacity building for climate adaptation. This certification aims to encourage global cities to reasonably protect and utilize wetland resources and set an example for global wetland ecological protection.

46. Panjin City was officially awarded the honored title of "International Wetland City" at the 14th Conference of the Parties to the Convention on Wetlands on November 5, 2022, becoming one of the second batch of 25 cities selected worldwide, and the first city in Liaoning Province to receive this honor. This certification is an international recognition of Panjin City's remarkable achievements in wetland protection. Panjin City has achieved this title mainly in the following aspects:

- i) Rich wetland resources: Panjin City has vast wetlands in the Liaohe Delta, with a total area of 249,600 hectares and a natural wetland protection rate of 57.27%. These wetlands provide important habitats for a variety of wild animals, including rare birds such as red-crowned cranes and black-headed gulls, and nationally protected animals such as seals.

- ii) Perfect protection agencies and regulations: Panjin City has established a special wetland protection management agency and formulated local regulations such as the "Panjin Wetland Protection Regulations" and the "Liaoning Liaohekou National Nature Reserve Management Measures", which provide solid legal protection for wetland protection.

- iii) Wetland ecological restoration projects: Panjin City has implemented a number of ecological restoration measures, including wetland restoration, dredging of tidal channels, and habitat restoration projects. These measures have effectively restored the ecological functions of wetlands and improved wetland biodiversity.

- Paris Agreement (2016). The long-term goal of the Paris Agreement is to limit the increase in global average temperature to well below 2°C above pre-industrial times and to pursue efforts to limit the increase in temperature to 1.5°C.

2.2 Main Social Policies

- (i). Opinions on Strengthening the Construction of Social Stability Risk Assessment Mechanism for Major Decisions under the New Situation (Zhongbanfa [2021] No.11)
- (ii). Notice on Printing and Distributing the Interim Measures for Social Stability Risk Assessment of Major fixed assets investment Projects of the National Development and Reform Commission (FGTZ [2012] No.2492)
- (iii). Notice of the General Office of the National Development and Reform Commission on Printing and Distributing the Outline of Social Stability Risk Analysis and Assessment Report of Major fixed assets investment Projects (Trial) (FGBTZ [2013] No.428)
- (iv). Interim Measures for Social Stability Risk Assessment of Major fixed assets investment Projects of Liaoning Provincial Development and Reform Commission (LFGTZ [2021] No.734)
- (v). Land Administration Law of the People's Republic of China (Third Revision in 2019)

- (vi). Implementation Regulations of the Land Administration Law of the People's Republic of China (Revised in 2021)
- (vii). Regulations on the Expropriation, Compensation and Resettlement of Houses on State owned Land (State Council Decree No.590 of the People's Republic of China)
- (viii). Notice of the General Office of the Liaoning Provincial Government on the Implementation Block Comprehensive Land Prices for Land Acquisition (LPGO [2010] No.2)
- (ix). Notice of the Office of the People's Government of Panjin City on Issuing the Interim Measures for Social Security of Landless Farmers in Panjin City (Panzhengbanfa [2017] No.115)
- (x). Notice on Carrying out Comprehensive Land Price Adjustment in Land Acquisition Areas issued by the Department of Natural Resources of Liaoning Province (Liaoning Natural Resources Office [2022] No.65)
- (xi). Notice on the Announcement and Implementation of Comprehensive Land Prices for Land Acquisition Areas (Liaoning Natural Resources Development [2023] No.24)
- (xii). Notice of the Department of Natural Resources of Liaoning Province on Further Improving the Pre review and Planning Site Selection of Land for Consolidated Construction Projects (Liaoning Natural Resources Regulations [2019] No.2)
- (xiii). Notice of the General Office of the Panjin Municipal Government on the Disclosure and Implementation of Block Comprehensive Land Prices for Land Acquisition in Panjin City (PMGO [2023] No.6)
- (xiv). Notice of the General Office of the Panjin Municipal Government on Issuing the Interim Measures for Social Security of Land-expropriated Farmers in Panjin City (PMGO [2017] No.115)
- (xv). Notice of the General Office of the Panjin Municipal Government on Issuing the Implementation Plan for the Collection and Benefit Guarantee of Pension Security Fees for Land-expropriated Farmers in Panjin City (PMGO [2020] No.11)
- (xvi). Notice of the General Office of the Panjin Municipal Government on Further Regulating the Expropriation of Residential houses on state-owned land and Compensation (PMGO [2014] No.90)
- (xvii). Notice of the Shuangtaizi District Government on Issuing the Acquisition and Compensation Program for Shantytown Reconstruction in Liaohe New Town (SDG [2018] No.9)
- (xviii). Labor Law of the People's Republic of China (Revised in 2018)
- (xix). Labor Contract Law of the People's Republic of China (Revised in 2012)
- (xx). Regulations on Labor Security Supervision of the State Council (2004)
- (xxi). Trade Union Law of the People's Republic of China (2021)
- (xxii). Occupational Disease Prevention and Control Law of the People's Republic of China (Revised in 2018)
- (xxiii). Law of the People's Republic of China on the Protection of Women's Rights and Interests (Revised in 2018)
- (xxiv). Special Regulations on Labor Protection for Female Workers of the People's Republic of China (2012)
- (xxv). Notice of the People's Government of Liaoning Province on Issuing the Measures for Implementing the Work Injury Insurance Regulations in Liaoning Province (Order No.316 of the People's Government of Liaoning Province)
- (xxvi). Regulations on the Protection of Labor Rights and Interests of Employees in Liaoning Province (2013)

- (xxvii). Law of the People's Republic of China on the Protection of Women's Rights and Interests (2023)
- (xxviii). Eliminating Workplace Sexual Harassment System (2023)
- (xxix). Labor Protection Measures for Female Workers in Liaoning Province (Order No.337 of the People's Government of Liaoning Province)
- (xxx). Measures for the Protection of the Rights and Interests of Female Workers in Liaoning Province (Revised in 2020)
- (xxxi). Measures for Public Participation in Environmental Impact Assessment (implemented from January 2019)
- (xxxii). Opinions of the General Office of the State Council on Promoting the Disclosure of Government Information in the Approval and Implementation Fields of Major Construction Projects (Guobanfa [2017] No.94)
- (xxxiii). Opinions of the General Office of the State Council on Promoting Government Information Disclosure in the Field of Public Resource Allocation (Guobanfa [2017] No.97)
- (xxxiv). Notice of the General Office of the Communist Party of China Central Committee and the General Office of the State Council on Issuing the Opinions on Comprehensively Promoting the Work of Government Openness (2016)
- (xxxv). Notice of the General Office of the Ministry of Natural Resources on Issuing the Guidelines for Grassroots Government Disclosure Standards for Rural Collective Land Acquisition (Natural Resources Office Letter [2019] No.1105)
- (xxxvi). Notice of the General Office of the Liaoning Provincial Committee of the Communist Party of China and the General Office of the Liaoning Provincial People's Government on Issuing the Implementation Rules for the Responsibility System of Petition Work (2017)
- (xxxvii). Liaoning Province Petition Regulations (2021)

2.3 Policies and Planning for Sponge Cities and Urban Drainage and Flood Control Systems

47. This project complies with the following policies for sponge cities and urban drainage and flood control systems:

- (i). "Guiding Opinions of the General Office of the State Council on Promoting the Construction of Sponge Cities" (State Council, Guobanfa [2015] No.75, 2015.10.16);
- (ii). "Notice on Carrying out Systematic and All-Area Promotion of Sponge City Construction Demonstration Work" (Ministry of Finance, Caibanjian [2021] No.35, 2021.4.25);
- (iii). "Implementation Opinions of the General Office of the State Council on Strengthening Urban Waterlogging Control" (Guobanfa [2021] No.11, 2021.4.8);
- (iv). "Notice on Further Clarifying the Requirements for Sponge City Construction" (Ministry of Housing and Urban-Rural Development, Jianbancheng [2022] No.17);
- (v). "14th Five-Year Plan" Urban Drainage and Flood Control System Construction Action Plan (Ministry of Housing and Urban-Rural Development, National Development and Reform Commission, Ministry of Water Resources, 2022.5.27);
- (vi). "Notice of the Ministry of Housing and Urban-Rural Development and other five departments on strengthening the construction, operation and maintenance of urban domestic sewage pipe networks" (Ministry of Housing and Urban-Rural Development, Construction [2024] No.18, March 8, 2024);

- (vii). "Notice of the General Office of the Ministry of Housing and Urban-Rural Development on Implementation of Urban Drainage and Flood Prevention in 2024" (Ministry of Housing and Urban-Rural Development, Jianbanchenghan [2024] No.106, 2024.3.27).

2.4 Applicable AIIB Environmental and Social Framework, Environmental and Social Policy and Environmental and Social Standards

48. Since this project will apply for a loan from the AIIB, the Environmental and Social Framework (ESF-2022.11) of the AIIB will apply to this project. The AIIB ESP provides guidance for good environmental and social management of AIIB-financed projects (projects), setting out mandatory requirements for the bank and its clients, including the identification, assessment and management of environmental and social risks and impacts associated with AIIB supported projects. The overall objective of AIIB ESP is to facilitate clients' development goals and outcomes through a comprehensive environmental and social management system. The AIIB ESP applies to public and private sector projects and aims to (i) support the environmental and social health and sustainability of projects, (ii) support the integration of environmental and social elements aspects of projects into the decision-making processes of all parties, and (iii) provide coping mechanisms for environmental and social risks and impacts during project identification, preparation and implementation. (iv) Guide clients to identify and manage environmental and social risks and impacts of projects, including climate change risks and impacts, (v) environmental and social screening and classification of projects, (vi) analyze potential risks and impacts, and (vii) propose measures to determine avoidance, reduction, mitigation and/or offset impacts, (viii) Identify environmental and social management provisions to be included in the project agreement, (ix) provide a sound public participation mechanism for stakeholders through environmental and social information disclosure, (x) provide a grievance redress mechanism at the project level, (xi) provide monitoring of environmental and social management measures, and (xii) promote knowledge sharing and dissemination of environmental and social management experience.

49. Its key elements are as follows:

- The AIIB's "Environmental and Social Policy (ESP)" applicable to this project include: "Environmental and Social Standard 1—Environmental and Social Risks and Impacts (ESS1)" in the "Environmental and Social Assessment and Management Policy" and "Land Acquisition and Involuntary Resettlement (ESS2)" and "Environmental and Social Exclusion List (ESEL)".
- Environmental and Social Standard 1(ESS1): Assessment and management of environmental and social risks and impacts. Environmental and Social Standard 1 (ESS1) aims to ensure the environmental and social robustness and sustainability of projects and supports the integration of environmental and social factors into project decision-making processes and implementation. ESS1 applies if the project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of environmental and social assessment and management measures is directly proportional to the risks and impacts of the project. ESS1 provides high-quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during project implementation. ESS1 defines detailed requirements for environmental and social assessments to be conducted for any project invested by the AIIB. ESS1 is triggered due to the adverse impacts on the ecology and environment and nearby residents during the project construction period and operation period.
- Environmental and Social Standard 2 (ESS2): Land Acquisition, Land Use Restrictions, and Involuntary Resettlement. If the project's screening process reveals that the project involves involuntary resettlement (including immediate 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; assets or acquired assets, sources of income or livelihood) due to (a) involuntary land acquisition; (b) involuntary restriction of land use or access to legally designated parks and protected areas. It covers such displacement, whether such loss and involuntary restraint is total or partial, permanent or temporary. ESS2 identifies detailed requirements for project resettlement plans involving involuntary resettlement. ESS2 is

triggered due to the potential additional land demands involved by the project.

- Environmental and Social Standard 3 (ESS3): s if Indigenous Peoples are present in, or have a collective attachment to, the proposed area of the Project, and are likely to be affected by the Project. ESS3 is not triggered because there is no ethnic minority residential area in the project area.

2.5 Comparison of Domestic Environmental and Social Management System and AIIB

50. China's environmental and social laws and regulations are basically consistent with the AIIB's environmental and social policies and environmental and social standards, but there are some differences in details. To address possible gaps and shortages, additional actions required by this project include:

i) **Preparation of environmental and social impact report:** According to the requirements of AIIB, the Panjin project needs to prepare a more comprehensive ESIA report, which not only covers the potential risk assessment of environmental and social impacts, but also includes the identification and assessment of associated facilities. In addition, the report needs to include the analysis of alternative solutions and climate change impacts of the project and formulate a detailed ESMP to ensure that the project design, construction and operation meet the environmental and social standards of AIIB.

ii) **Public consultation and participation:** The project needs to implement a more extensive public consultation and stakeholder participation mechanism to ensure continuous feedback from project-affected peoples during the project design, preparation, implementation and operation stages. In particular, attention should be paid to the participation of vulnerable groups, and establishment of information sharing, consultation and participation mechanisms to improve the transparency and public participation of the project.

iii) **Grievance Redress Mechanism (GRM):** Establishment of a formal grievance redress mechanism (GRM) to ensure that project-affected people can express their concerns and dissatisfaction with social and environmental aspects at any stage of the project, and obtain timely processing and feedback. The GRM required by AIIB needs to be clarified in the ESIA, and the existence and use of the mechanism should be communicated to the public.

iv) **Information disclosure:** According to AIIB's requirements, the project must publish environmental and social documents (including ESIA, ESMP, etc.) on the municipal government website for at least 60 days before AIIB approves the loan. Information disclosure must include the project's environmental and social risks, potential impacts and mitigation measures, so that stakeholders can fully understand the project and enhance transparency.

v) **Social impact assessment:** Based on the domestic social stability risk assessment, the project needs to further expand the scope of social impact and prepare a social impact assessment report that meets AIIB requirements, covering social impact, stakeholder analysis, social adaptability and risk analysis, and pay attention to special groups such as ethnic minorities, gender and involuntary resettlement in the social management plan. In addition to this report, this project also needs to prepare a resettlement action plan (RAP).

Table 2-1 Comparative analysis of environmental and social policies between China and AIIB

Items	AIIB requirements	Chinese requirements	Comparative analysis
Environmental and Social Policies and Regulations	The AIIB requires the adoption of the AIIB's environmental and social framework, and projects applying for AIIB loans must adopt environmental and social policies and environmental and social standards.	China has a series of complete general environmental laws and policies. Construction projects should carry out environmental impact assessments and Environmental protection measures shall comply with environmental quality standards, and at the same time must meet local environmental laws and regulations and relevant requirements. Section C 1.1 details applicable domestic environmental laws and regulations. China has no direct laws and administrative regulations on social impact assessment, but project construction should be based on the " Provisional Regulations on Major Administrative Decision-making Procedures ", "National Development and Reform Commission Interim Measures for Social Stability Risk Assessment of Major Fixed Asset Investment Projects", " Regulations for the Implementation of the Land Administration Law of the People's Republic of China " There are corresponding administrative regulations or rules on social impact assessment, such as the Regulations for the Implementation of the Management Law, and the National Development and Reform Commission 's "Government Investment Project Feasibility Study Compilation Outline" (2023) has chapter requirements for social assessment and social stability risk assessment, and must meet local related requirements. Section C 1.2 introduces in detail the applicable domestic laws and regulations related to social impact assessment.	Domestic environmental policies and regulations are basically similar to the environmental and social policies of the AIIB. However, domestic environmental policies and regulations focus more on mitigating the adverse impact of construction projects on the environment, while the AIIB focuses on the comprehensive impact on the environment and society. There are no special laws and regulations on social impact assessment in China, but it is stipulated that social assessment and social stability risk assessment must be carried out in the project feasibility study, and social stability risk assessment must pass the review and record. Social stability risk assessment is a unique social risk governance system in China. The project should adopt more stringent regulations while meeting domestic and AIIB requirements.
Environmental Social Category	The AIIB will screen and classify projects as early as possible to determine the nature and level of environmental and social assessment, information disclosure and stakeholder engagement required by the client for	The "Construction Project Environmental Impact Assessment Classification Management Catalog (2021 Edition)" is based on the characteristics of construction projects and the environmental sensitivity of the area where it is located, and comprehensively considers the possible impact of construction projects on the environment. The impact assessment is classified into three categories: (1) preparation of	According to the requirements of the AIIB, this project is assessed as Category A. This project has four components: (i) wetland restoration and conservation, (ii) sponge city

	<p>the project. The AIBB classifies projects according to their highest environmental and social risks and potential impacts (including direct, indirect, cumulative and induced impacts on the project site). The AIBB divides projects into four categories: (1) Category A, (2) Category B, (3) Category C, and (4) Category FI. Different types of environmental and social impact assessments have different requirements.</p>	<p>environmental impact report (2) preparation of environmental impact report form (3) preparation of environmental impact registration form According to the "Guidelines for Social Assessment of Municipal Public Facilities Construction Projects" issued by the Ministry of Housing and Urban-Rural Development of the People's Republic of China, social assessments are required for: municipal water supply, drainage, heating, gas, domestic waste disposal, urban rail transit, urban social assessment of the entire project cycle of roads and bridges, urban landscaping projects (including project pre-stage, preparation stage, implementation stage and operation stage).</p>	<p>infrastructure transformation, (iii) digitalization of urban drainage management system, (iv) capacity building. According to the domestic environmental impact assessment regulations, if the construction content involves two or more project categories in this list, the environmental impact assessment category shall be determined according to the highest single level among them. The Project needs to prepare environmental impact report forms. According to domestic guidelines, this project involves municipal projects such as urban roads and urban rail transit, and a social assessment report needs to be prepared.</p>
<p>Preparation of environmental and social impact assessment report</p>	<p>According to environmental and social policies, category A projects need to prepare environmental and social impact assessment reports, environmental and social management plans, and resettlement plans. The environmental and social impact assessment report includes: (1) Project description, including the map of the project area; (2) Policy, legal and administrative framework, including the domestic and international legal framework applicable to the project; (3) Project scope, including stakeholders Identification and consultation plan; (4) analysis of alternatives; (5) baseline</p>	<p>According to the "Category of Management Directory of Environmental Impact Assessment of Construction Projects (2021 Edition)", the Project needs to prepare an environmental report form. According to the "Guidelines for Social Evaluation of Municipal Public Facilities Construction Projects" issued by the Ministry of Housing and Urban-Rural Development of the People's Republic of China, social analysis is required for municipal construction projects. Social analysis includes (social impact analysis, stakeholder analysis, social mutual adaptability analysis, social risk analysis, project sustainability analysis), social management plan and implementation monitoring and evaluation, expropriation and compensation plan and implementation plan, also need to pay attention to the analysis of special affected groups (poverty, social and gender, ethnic minorities, involuntary resettlement).</p>	<p>The environmental and social impact assessment prepared by the AIBB for Category A projects not only evaluates the potential environmental and social risks and positive and negative impacts of the project, but also compares and analyzes feasible alternatives, and recommends any necessary measures to avoid, minimize, reduce, offset or compensate for adverse impacts and improve the environmental and social performance of the project.</p>

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	<p>environmental and social data; (6) evaluation of environmental and social risks and impacts; (7) analysis of risks and impacts related to climate change; (8) public consultation and information disclosure; (9) development of mitigation, monitoring and management measures and actions in the form of environmental management plans or environmental impact assessments.</p> <p>In addition, the AIIB Environmental and Social Framework requires that environmental and social risks and impacts of associated facilities⁴ be identified and assessed in an environmental and social assessment.</p>		<p>Therefore, on the basis of the report form, the Project will also adopt more strict requirements of the AIIB to prepare an environmental and social impact assessment report. The scope of the assessment includes identified associated facilities in addition to project facilities.</p>
Environmental and Social Management Plan	<p>The AIIB requires Category A projects to prepare the ESMP, which must propose plans to manage and mitigate environmental and social risks and impacts, including: (1) Mitigation measures (2) Environmental and social monitoring and reporting requirements (3) institutional arrangements</p>	<p>No need to prepare a separate environmental management plan or any other environmental documents.</p> <p>According to the "Guidelines for Social Evaluation of Municipal Public Facilities Construction Projects" issued by the Ministry of Housing and Urban-Rural Development of the People's Republic of China, municipal construction projects need to conduct social analysis, prepare social management plans and implement monitoring and evaluation. According to the "Land Administration Law of the People's Republic of China" and the "Regulations on Compensation for Acquisition of Houses on State-Owned Land", if the acquisition of land and houses is involved, it is necessary to prepare a compensation and resettlement plan for land acquisition</p>	<p>Both consider environmental and social impacts of the project, pay attention to ethnic minorities, social and gender, involuntary resettlement, vulnerable groups, etc., The domestic requirement only require the development of a comprehensive social management plan, with the lack of special gender action plan (GAP), ethnic minority development plan (EMDP). This project adopts stricter AIIB requirements and incorporates the ESMP into the ESIA report.</p>
Public Consultation	<p>The AIIB requires at least one meaningful consultation for all</p>	<p>Domestically, the preparation of the "Environmental Impact Report" requires public consultation, and the preparation of the "Environmental</p>	<p>According to the requirements of the AIIB and domestic</p>

⁴ AIIB Environmental and Social Framework 2022 Para 35. Associated facilities are activities that are not included in the description of the Project set out in the Legal Agreements governing the Project, but which, following consultation with the Client, the Bank determines are: (a) directly and materially related to the Project; (b) carried out, or planned to be carried out, contemporaneously with the Project; and (c) necessary for the Project to be viable and would not be carried out if the Project did not exist.

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	<p>Category A, B, and C projects. The opinions of affected people and stakeholders will be solicited at all stages of project development. During the design, preparation and implementation of projects, comments received during project preparation and implementation shall be considered. Constant consultation mechanisms are required throughout the whole project lifecycle to disclose information and seek feedback. The results of the public consultation shall be recorded in the ES documents.</p>	<p>Impact Report Form" and the "Environmental Impact Registration Form" do not require public consultation. The Ministry of Housing and Urban-Rural Development of the People's Republic of China "Guidelines for Social Evaluation of Municipal Public Facilities Construction Projects" stipulates that social evaluation should focus on public engagement, build an effective engagement mechanism for different stakeholders in the project, and analyze the degree of stakeholder engagement affected by the project, including participation in project preparation, decision-making, construction, operation management, and opportunities to share the results of the project and the opportunities created by the project, and shall pay special attention to the possibility and degree of participation of vulnerable groups. A participatory framework including sharing mechanisms, consultation mechanisms and engagement mechanisms to improve the effectiveness of stakeholder engagement shall be established. According to the State Council Order No.713 "Regulations on Major Administrative Decision-Making Procedures", public engagement is required before major decisions are made.</p>	<p>policies and regulations, public consultations have been carried out with stakeholders and affected groups, and the feedback obtained from the public consultations is finally reflected in the ESIA.</p>
<p>GRM</p>	<p>The AIIB requires the establishment of a Grievance Redress Mechanism (GRM) for receiving, evaluating and facilitating for addressing arrangements caused concerns, complaints and grievances of affected people regarding the social and environmental performance of borrowers /clients in projects. GRM is important for development projects where adverse impacts or risks are occurring or expected. It also includes information on the AIIB 's Project-Affected Person's Mechanism (PPM), including how to access it, which must be included in project and subproject environmental and social documents and disseminated by the GRM.</p>	<p>The Interim Measures for Public Consultation on Environmental Impact Assessment (Ministry of Environmental Protection, 2006) clearly requires project proponents to provide a GRM for stakeholders to raise their concerns, comments or complaints during project preparation. During the project implementation phase, the National Construction Management Standard (Construction Safety Inspection Standard - JGJ59-2011) clearly requires the contractor to disclose the GRM at the project site, so that stakeholders affected by the project can raise complaints or concerns to the contractor. In addition to project-specific GRM, China has established a formal environmental petition system through which any citizen, legal person, or organization can lodge a petition with environmental departments at all levels through letters, emails, faxes, telephone calls, and personal visits. Domestic guidelines point out that the project shall set up a special mechanism for accepting and handling grievances and complaints, and promptly publish the results of grievances and complaints. A grievance application can be submitted to the PIU, community organization, government department and other responsible agencies and project implementation and management personnel in non-written form, or a formal written grievance application can be submitted to the relevant responsible agency or department. According to the "Guiding Opinions on Further Optimizing Local Government Service Convenience Hotlines" issued by the General Office of the State Council, all localities have</p>	<p>Consistent, to establish a formal GRM, has been included in this report.</p>

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		established a 12345 hotline social supervision mechanism to accept various inquiries, help, complaints, reports, and suggestions from enterprises and the public.	
Information Disclosure	<p>The AIIB requires disclosure of project information to allow stakeholders to understand project risks and impacts, as well as potential opportunities.</p> <p>The client to post the draft ESIA, ESMPs, ESMPFs, resettlement plans, RPFs, Indigenous Peoples plans and IPPFs, or other approved forms of documentation, through its website, for Category A project 60 days and for Category B project 30 days, prior to Bank's approval.</p>	<p>Domestically, domestic environmental impact assessments are required to be disclosed on the website of the local Ecological Environment Bureau within a limited period of time.</p> <p>According to the Regulations on the Disclosure of Government Information of the People's Republic of China, the administration institution shall actively publicize the approval and implementation of major construction projects, as well as government information that involves the adjustment of public interests, needs to be widely awareness by the public, or requires public engagement in decision-making. In addition, the administration institution shall actively disclose government information related to municipal construction, public services, land acquisition, house acquisition, public security management, etc. The disclosure approaches include government bulletins, government websites or other Internet government media, press conferences, newspapers, radio, television, and other channels. The domestic guideline points out that during the project implementation process, the project design plan, resettlement plan, environmental assessment report, and social assessment report should be published on government information disclosure platforms (radio, television, website, etc.) to accept public supervision.</p>	<p>This report (Both Chinese and English version) must be published on the Panjin Municipal People's Government related website for sixty (60) calendar days prior to consideration of the AIIB's financing for approval</p>

2.6 Applicable Standards for Environmental Impact Assessment

51. The AIB's Environmental and Social Framework (ESF) (revised in 2022) requires projects to comply with international good-practice pollution prevention technologies and practices, such as the Environmental Health and Safety Guidelines - General 5(2017) of World Bank Group and other internationally recognized standards. Therefore, this project is aligned with standards that is stricter in the internationally recognized standards and domestic standards. The specific applicable standard values are as follows:

2.6.1 Environmental Quality Standards

(i) Ambient Air Quality Standards

52. Ambient Air Quality Standard (GB3095-2012) of China divides air quality into two categories. Class I standards apply to special areas such as nature reserves and environmentally sensitive areas, and Class II standards apply to all other areas, including urban and industrial areas. The location of this subproject belongs to the Class II ambient air quality functional area. The World Bank Group's Environmental Health Safety Guidelines are based on the Global Air Quality Guidelines of WHO⁶. The Global Air Quality Guidelines provide guidance on thresholds and limits for key air pollutants that compose health risks. In addition to the guideline values, Global Air Quality Guidelines of WHO also set out transitional targets aimed at facilitating a gradual shift from high concentrations to low concentrations. Table 2-2 compares the Class II standard of the "Ambient Air Quality Standards" (GB 3095-2012) with the WHO standards. The Class II standard limit of 24-hour SO₂ (0.15 mg/m³) in the "Ambient Air Quality Standards" (GB3095-2012) is higher than the upper limit of the World Bank Group's interim standard (0.125 mg/m³); while the Class II standard limit of 24-hour PM₁₀ (0.15 mg/m³) and PM_{2.5} (0.075 mg/m³), the annual average NO₂ (0.04 mg/m³) and PM_{2.5} (0.035 mg/m³) are respectively the same as the upper limit of the transition period standard of WHO. In general, domestic standards are highly equivalent to WHO guidelines or interim target values, so this project adopts the Class II standard of "Ambient Air Quality Standards" (GB3095-2012) on amendment sheet, and the 24-hour SO₂ adopts the WHO standard.

Table 2-2 Comparison between GB 3095-2012 and WHO Global Air Quality Guidelines (unit: mg/m³)

No.	Pollutants	Averaging Period	GB 3095-2012 (Class II)	WHO Global Air Quality Guidelines	
				Transition goals	Target
1	SO ₂	1 year	0.06	none	none
		24 hours	0.15	0.05-0.125	0.04
		1 hour	0.50	none	none
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	none	none	none
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	none	none
5	CO	24 hours	4.0	7.0	4.0
		1 hour	10.0	none	none
6	O ₃	Maximum average of 8 hours per day	0.16	0.12-0.16	0.10
		1 hour	0.20	none	none

(ii) Environmental Quality Standards for Surface Water

53. The World Bank Group's EHS Guidelines do not provide reference standards for surface water quality.

⁵World Bank. (2017). Environmental, Health, and Safety Guidelines

⁶WHO. (2021). Global Air Quality Guidelines

The "Panjin Environmental Quality Bulletin 2023" states the water quality of the Panjin section of the Liaohe River in 2023 that the water quality of the Panjin section of the Liaohe River and the section of Panjin Xing'an and Shuguang Bridges meets the Class III standard, and the water quality of the Zhaoquan River section meets the Class IV standard; the water quality of six sections including the Zhabei Bridge section of Xiaoliu River, Zhonghua Road Bridge section of Yitong River, Yugangzi section of Pangxiogou River, Xinsheng Bridge section of Taiping River, Lake Shenglitang section of Raoyang River and Qingshuihe River Gate section of Qingshui River, meets the Class IV standard, , all of which have reached the corresponding assessment targets ².

(iii) Groundwater

54.The environmental quality standard for groundwater implements the Class III standard in the "Groundwater Quality Standard" (GB/T14848-2017), see Table 2-3.

Table 2-3 Groundwater Quality Standard (unit: mg/L)

No.	Item	Standard Limit	No.	Item	Standard Limit
1	pH (dimensionless)	6.5 ~ 8.5	16	Arsenic	≤ 0.01
2	Total Hardness (calculated as CaCO ₃)	≤450	17	Cadmium	≤ 0.005
3	Total Dissolved Solids	≤ 1000	18	Hexavalent Chromium	≤ 0.05
4	Sulfate	≤ 250	19	Lead	≤ 0.01
5	Chloride	≤ 250	20	Copper	≤ 1.0
6	Nitrite Nitrogen	≤ 1.0	21	Zinc	≤ 1.0
7	Nitrate (As N)	≤ 20	22	Aluminum	0.2
8	Sodium	≤ 200	23	Manganese	0.1
9	Oxygen Consumption (Cod _m Method, Calculated As O ₂)	≤3.0	24	Iron	0.3
10	Volatile Phenols (Calculated As Phenol)	≤0.002	25	Total Number Of Colonies	100
11	Cyanide	≤0.05	26	Total Coliforms	3.0
12	Fluoride	≤1.0			
13	Sulfide	≤0.0 2			
14	Ammonia Nitrogen	≤0.5 _			
15	Hg	≤ 0.001			

(iv) Soil standard

55.The soil environment quality standard for construction land within the evaluation scope shall implement the screening value standard for the Category II of land in the "Soil Environmental Quality-Standards for Soil Pollution Risk Management and Control of Construction Lands" (GB36600-2018).

Table 2-4 Screening Value and Control Value of Soil Pollution Risks for Construction Land (unit: mg/kg)

No.	Pollutant Item	CAS number	Screening Value		Control Value	
			Category I Land	Category II Land	Category I Land	Category II Land
Heavy Metals and Inorganics						
1	Arsenic	7440-38-2	20 ^①	60 ^①	120	140
2	Cadmium	7440-43-9	20	65	47	172
3	Chromium (Hexavalent)	18540-29-9	3.0	5.7	30	78

² [Panjin City Environmental Quality Bulletin 2022 - Environmental Protection - Panjin Municipal People's Government \(panjin.gov.cn\)](http://panjin.gov.cn)

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4	Copper	7440-50-8	2000	18000	8000	36000
5	Lead	7439-92-1	400	800	800	2500
6	Hg	7439-97-6	8	38	33	82
7	Nickel	7440-02-0	150	900	600	2000
Volatile Organic Compounds						
8	Carbon Tetrachloride	56-23-5	0.9	2.8	9	36
9	Chloroform	67-66-3	0.3	0.9	5	10
10	Chloromethane	74-87-3	12	37	31	120
11	1,1-Dichloroethane	75-34-3	3	9	20	100
12	1,2-Dichloroethane	107-06-2	0.52	5	6	twenty one
13	1,1-Dichloroethene	75-34-4	13	66	40	200
14	Cis-1,2-Dichloroethene	156-59-2	66	596	200	2000
15	Trans-1,2-Dichloroethene	156-60-5	10	54	31	163
16	Dichloromethane	75-09-2	94	616	300	2000
17	1,2-Dichloropropane	78-87-5	1	5	5	47
18	1,1,1,2-Tetrachloroethane	630-20-6	2.6	10	26	100
19	1,1,1,2-Tetrachloroethane	79-34-5	1.6	6.8	14	50
20	Tetrachlorethylene	127-18-4	11	53	34	183
21	1,1,1-Trichloroethane	71-55-6	701	840	840	840
22	1,1,2-Trichloroethane	79-00-5	0.6	2.8	5	15
23	Trichlorethylene	79-01-6	0.7	2.8	7	20
24	1,2,3-Trichloropropane	96-18-4	0.05	0.5	0.5	5
25	Vinyl Chloride	75-01-4	0.12	0.43	1.2	4.3
26	Benzene	71-43-2	1	4	10	40
27	Chlorobenzene	108-90-7	68	270	200	1000
28	1,2-Dichlorobenzene	95-50-1	560	560	560	560
29	1,4-Dichlorobenzene	106-46-7	5.6	20	56	200
30	Ethylbenzene	100-41-4	7.2	28	72	280
31	Styrene	100-42-5	1290	1290	1290	1290
32	Toluene	108-88-3	1200	1200	1200	1200
33	M-Xylene + P-Xylene	108-38-3, 106-42-3	163	570	500	570
34	O-Xylene	95-47-6	222	640	640	640
Semi-Volatile Organic Compounds						
35	Nitrobenzene	98-95-3	34	76	190	760
36	Aniline	62-53-3	92	260	211	663
37	2-Chlorophenol	95-57-8	250	2256	500	4500
38	Benz[A] Anthracene	56-55-3	5.5	15	55	151
39	Benzo[A] Pyrene	50-32-8	0.55	1.5	5.5	15
40	Benzo[B] Fluoranthene	205-99-2	5.5	15	55	151
41	Benzo[K] Fluoranthene	207-08-9	55	151	550	1500
42	The	218-01-9	490	1293	4900	12900
43	Dibenzo[A,H] Anthracene	53-70-3	0.55	1.5	5.5	15
44	Indeno [1,2,3-Cd] Pyrene	193-39-5	5.5	15	55	151
45	Naphthalene	91-20-3	25	70	255	700
46	Petroleum Hydrocarbon	-	826	4500	5000	9000

① Note: The land plot which the detected content of pollutants in the soil of a specific plot exceeds the screening value, but is equal to or lower than the background value of the soil environment (see "Soil Environmental Quality-Standards for Soil Pollution Risk Management and Control of Construction Lands (Interim)" (GB36600-2018) 3.6) shall be not incorporated into the polluted land management. The background value of soil environment refers to Appendix A of "Soil Environmental Quality-Standards for Soil Pollution Risk Management and Control of Construction Lands (Interim)" (GB36600-2018) 3.6).

(v) Acoustic environment quality standards

56. Comparing the standards of each functional area with the World Bank Group EHS Guidelines listed in Table 2-5, the noise standard value for Class 1 areas in the "Ambient Quality Standard for Noise" (GB3096-2008) is the same as the World Bank Group EHS Guidelines. For industrial areas and areas on both sides of trunk roads, domestic standards are stricter than the World Bank Group standards. According to the "Notice of the Panjin Municipal People's Government on Issuing the Panjin Urban Area

Acoustic Environment Functional Zoning Plan" (Panzhengfa [2022] No.18) 7, the areas where the Taiping River Pump Station District Stormwater Pipeline Reconstruction Project, the Jinpanhe Street Pump Station and Upstream Stormwater Pipeline Reconstruction Project, and the Gujia Pump Station Reconstruction and Stormwater and Sewage Diversion Project are identified as Class 3 acoustic environment functional zones, and standards of Class 3 standards are implemented; the areas where the Bayi Pump Station Reconstruction and Stormwater and Sewage Diversion Project, the Nanqian Pump Station Reconstruction and Diversion Project, the Gaojia Pump Station Reconstruction and Stormwater and Sewage Diversion Project are located, Zhuanglin Pump Station, Tianjia Ecological Corridor Project, Tianjia Sub-district Stormwater and Sewage Diversion Project, Chengbei District Slope Protection Project, and Chunjiang Street Stormwater Forced Drainage Pump Station Project are Class 2 acoustic environment functional zones, and standards of Class 2 are implemented; the area on the west side of the Zhonghua Road drainage pipeline project is a Class 3 acoustic environment functional zone, and the standards of Class 3 are implemented, and the east side is a Class 2 acoustic environment functional zone, and the standards of Class 2 are implemented; the area where the flood-prone point reconstruction project near Century Square is located is a Class 1 acoustic environment functional zone, and the standards of Class 1 are implemented.

Table 2-5 Noise environment quality standards (equivalent sound level: LAeq: dB)

Acoustic environment functional area category	Applicable areas	GB 3096-2008		World Bank Group EHS Standards	
		Daytime	at night	Daytime	at night
0	Areas that require extreme quietness, such as recuperation areas	50	40	55	45
1	Areas mainly used for residence, cultural and educational institutions	55	45		
2	Mixed residential, commercial and industrial areas	60	50		
3	Industrial Area	65	55	70	70
4a	Areas on both sides of urban road trunk lines	70	55		
4b	Areas on both sides of the railway line	70	60		

2.6.2 Pollutant emission standards

(i) Air pollutant emission standards

57. The exhaust gas emission in the construction period and operation period shall implement relevant standards in the "Comprehensive Emission Standards of Air Pollutants" (GB16294-1996); the dust emission in the construction period shall implement relevant standards in the "Dust Emission Standards for Construction and Stacking Sites of Liaoning Province" (DB21/2642-2016). The odorous gas from the pump station shall comply with the requirements of the Class 2 standard in Table 2-8 for new, modified and expanded construction of the "Emission Standard of Odor Pollutants" (GB14554-93).

Table 2-6 "Comprehensive Emission Standard of Air Pollutants" (GB16294-1996) Unit: mg/m³

Pollution Factor	Sulfur Dioxide	Nitrogen Oxides	Particulates
Standard Limit	0.12	0.4	1.0
Remark	Fugitive emission monitoring concentration limit		

Table 2-7 "Dust Emission Standards for Construction and Stockpiling Sites in Liaoning Province" (DB21/2642-2016) Unit: m g/m³

Item	Area	Concentration Limit
Particulates	According to Urban Areas	0.8

Table 2-8 Standard values of odor pollutants at factory boundaries (GB14554-93) Unit: mg/ m³

⁷ Notice of the Panjin Municipal People's Government on [Issuing the Panjin Urban Area Acoustic Environment Functional Zoning Plan Departmental Regulatory Documents Panjin Municipal Ecological Environment Bureau \(panjin.gov.cn\)](#)

Control Project	unit	Class 2
		New renovation and expansion
NH ₃	mg/ m ³	1.5
H ₂ S	mg/ m ³	0.06
Odor concentration	mg/ m ³	20

(ii) Noise Emission Standards

58. The noise emission during the construction period of the project shall comply with the relevant standards of the "Environmental Noise Emission Standards at the Boundary of Construction Sites" (GB12523-2011); the noise emission during the operation period shall comply with the Class I standards of the "Environmental Noise Emission Standards at the Boundary of Industrial Enterprises" (GB12348-2008). In addition, the World Bank EHS guidelines require that the background noise increase from the nearest receiving point outside the site should not exceed 3 dB.

Table 2-9 "Environmental Noise Emission Limits at Construction Site Boundary" (GB12523-2011)

Category	During the Day	At Night
Standard Limit: dB(A)	70	55

Table 2-10 "Environmental Noise Emission Standards at the Boundary of Industrial Enterprises" (GB12348-2008)

Category	During the Day	At Night
Standard Limit: dB(A)	55	45

(iii) Sewage Discharge Standards

59. Sewage discharge from construction sites shall comply with China's "Comprehensive Sewage Discharge Standard" (GB 8978-1996). The Class I standard applies to discharges discharged into Category III water bodies under GB 3838-2002. The Class II standard applies to discharge into the Category IV and Category V water bodies. The Class III standard applies to municipal sewer discharges that enter municipal sewage treatment plants for secondary treatment. The domestic sewage during the construction period relies on the existing municipal sewage treatment facilities, and the sewage discharge at the construction site implements the Class III standard.

Table 2-11 Integrated Wastewater Discharge Standards (GB8978-1996)

Parameter	Class I	Class II	Class III
	Suitable for discharge into Category III water bodies	Suitable for discharge into Category IV and Category V water bodies	For discharge to municipal sewer
pH	6-9		
SS mg/L	70	150	400
BOD ₅ mg/L	20	30	300
COD mg/L	100	150	500
Volatile phenol mg/L	0.5	0.5	2.0
NH ₃ -N mg/L	15	25	---
LAS (= anionic surfactant) mg/L	5.0	10	

(iv) Solid waste

60. For general industrial solid waste, the relevant requirements in the Standards for Pollution Control of General Industrial Solid Waste Storage and Landfill (GB18599-2020) shall be followed.

(v) Vibration

61. The vibration generated during the operation of construction machinery and roads and railways shall implement the "Urban Regional Environmental Vibration Standards" (GB10070-88).

Table 2- 12 Standard values of vertical Z-level vibration in various areas of cities

Applicable Area	Daytime (dB)	Night (dB)
Special residential area	65	65
Residential area, cultural and educational area	70	67
Mixed area, central business district	75	72
Industrial Zone	75	72
Both sides of traffic arterial roads (both sides of roads with a traffic flow of more than 100 vehicles per hour)	75	72
Both sides of the main railway line (the residential area on both sides of the outer rail of the railway with a daily traffic flow of no less than 20 trains 30 m away)	80	80

2.6.3 Ecological and Biodiversity Protection

62. AIIB's ESF has made provisions for biodiversity and ecological protection, especially in ESS 1 Environmental and Social Assessment and Management System:

- i) **Biodiversity protection:** The AIIB emphasizes avoiding or reducing the damage of projects to natural habitats, protected areas and biodiversity hotspots. The AIIB requires measures to be taken during project design and implementation to protect the biodiversity and ecosystem functions of the project site.
- ii) **Protection of critical habitats and sensitive areas:** For important habitats and ecologically sensitive areas, the AIIB requires strict EIA for projects to avoid irreversible damage to these areas. Critical habitats that may be involved in the project need special protection to avoid negative impacts on them as much as possible.

63. The main domestic laws, regulations and policies related to ecological and biodiversity protection are as follows:

- i) The Wetland Law stipulates a wetland protection red line system, which sets a protection red line for wetlands with important ecological functions and vulnerabilities. Wetlands within the protection red line are subject to strict development restrictions, and any change in the use of wetlands must be strictly approved, and compensation and restoration measures must be taken.
- ii) National Biodiversity Conservation Strategy and Action Plan (NBSAP): As China's action program for implementing the Convention on Biological Diversity, NBSAP stipulates the overall goals of biodiversity conservation in China, priority protected areas, ecosystem restoration and species protection measures, covering forests, wetlands, grasslands, oceans and other ecosystems.
- iii) National Ecological and Environmental Protection "14th Five-Year Plan": The plan proposes the ecological red line system, ecological restoration projects and biodiversity protection, and takes biodiversity protection as a key content of ecological civilization construction.
- iv) Ecological Protection Red Line Delineation Plan: The ecological protection red line system delineates national key ecological functional areas to prevent the degradation of key ecosystems. All development projects involving ecological red lines are subject to strict EIA.

64. This project does not involve important wetlands, nature reserves and ecological red lines within the construction scope.

3 Project Description

3.1 Project Background

65. Panjin City is located in the Liaohe alluvial plain, with a low altitude and flat terrain. The city's development is affected by the coastline and the Liaohe River. As Panjin City develops, existing problems are gradually emerging:

66.i) **Insufficient urban drainage system and lack of regulation capacity.** Due to the continuous expansion of urban construction, the extensive drainage system, and the increasing amount of water discharged into the receiving water body due to extreme climate in recent years, the demand for water discharge in the drainage channel has increased year by year. The drainage capacity of the main drainage channels in Panjin City is uneven, and the runoff cannot be effectively drained under extreme weather conditions, as well there is a lack of connectivity between the channels.

67.ii) **Old drainage system with low design standards.** Panjin's existing pipeline network was basically built at the same time as the city was developed. Many drainage pipelines are old (especially the Yitong River, Pangxiogou River, and Liuling River sub-districts on both sides of the Liaohe River. The main pipelines were built in the 1970s and 1980s), with low pipeline design standards, small design drainage volume and low loading capacity.

68.iii) **Frequently urban waterlogging and weak climate change resistance.** Panjin City has a flat terrain, and rainwater drainage relies on the terminal drainage pump station. If the pipeline design of the pump station area is reasonable and the pump station operates smoothly, the area is not prone to waterlogging risks. Due to the flat terrain of Panjin, the slope of the laid pipeline is small, and the sludge carried in the sewage is easy to sediment. After years of use, a large amount of sludge has accumulated in the pipeline. In addition, the maintenance efforts are not strong enough, resulting in a serious decline in the water-passing capacity of the pipeline, which is unable to meet the large amount of rainwater collection and discharge. In addition, the capacity of the drainage pump station is limited, and some lifting pump station equipment is aging or even damaged. The designed drainage capacity is insufficient, resulting in the failure to remove rainwater in the pipeline network in time, affecting the discharge capacity of the entire system. In recent years, extreme climate has occurred frequently, especially short-term heavy rainfall, the drainage system is unable to respond in time, and the climate change resistance is weak.

69.iv) **Combined system overflow pollution threatens the water environment quality.** Panjin's current rainwater and sewage diversion system is imperfect, and the community, municipality and pump station cannot achieve diversion simultaneously, resulting in false diversion. In fact, it is still in a combined system at the terminal, with the risk of overflow pollution. In addition, most of the combined system lifting pump station equipment in Panjin City is aging or even damaged, resulting in the failure to remove sewage in the pipeline network in time, affecting the discharge capacity of the entire system. Almost all drainage pump stations are built for rainwater and sewage. The two systems share a set of water inlet facilities, which causes a large amount of sewage to be discharged into the water body when rainwater is discharged, causing pollution.

70.v) **Isolated urban wetlands, water systems, and green spaces with fragile ecological function.** Panjin's urban water system network is well developed, and the current ecological environment construction in the urban area is relatively good. However, there are still some areas in the urban area with poor connectivity between blue and green infrastructure networks. Urban development and urban space expansion have led to the reduction of ecological land such as rivers, wetlands, and grasslands, thus causing ecological and environmental problems such as landscape pattern fragmentation and reduced biodiversity.

71.vi) **Old drainage facilities with low level of facility automation, and the low intact rate.** Panjin's drainage and flood control system is based on the strong discharge of pump stations, the sewage from each district is lifted and then enters the sewage interception main pipe. According to statistics, there are 75 major rain and sewage pump stations in Panjin with long histories. The equipment has age limitations which most of the equipment has high energy consumption and low automation level, and basically relies on manual drive. As the service life increases, most of the equipment is old and the operating

efficiency is low. Most of the equipment with operation risks needs upgrading.

72.vii) **Backward operation and management model, insufficient information technology.** The existing drainage system in Panjin City has problems such as incomplete census data, backward management methods, and inadequate post-maintenance, which leads to damage and siltation of drainage pipes, affecting pipeline drainage.

73. In response to climate change and the frequent urban waterlogging and wetland degradation in Panjin City in recent years, this Project will implement stormwater and sewage diversion, water system interconnection and wetland ecological restoration projects to improve the drainage efficiency and early warning and emergency response capabilities of the stormwater and sewage systems, achieve wetland ecological restoration, reduce the risk of waterlogging in Panjin City, and thereby reduce the risk of environmental pollution caused by sewage overflow, and ultimately build a climate-resilient demonstration city with smart management and low-impact development.

74. This Project consists of four components:

75. **Component 1: Wetland restoration and conservation.** This component includes 5 urban drainage canals connection subprojects such as the Yijiang Road drainage system connection subproject. By building approximately 5.14 km of new rainwater pipes, 1.42 km of new sewage pipes, renovating approximately 8.3 km of existing open channels, 0.98 km of new culverts, renovating 0.4 km of culverts, and building 1.481 km of new roads, the effective connection between urban drainage canals will be achieved. The landscape of four urban wetland parks (Liaohu Sluice Park, Liaohu Stele Forest Park, Tianjia Ecological Corridor, and Hundred Mu Lotus Pond) will be improved, a total of area of 149.8 ha. Through five ecological shoreline projects, including the Urban North Drainage Slope Protection Project, 2.1 km of slope protection along the urban canal and 17.2 km of riverbank landscape will be improved. Two urban ecological green island subprojects of Shuangtaizi District and Xinglongtai District will be constructed, with a total of 21 urban green spaces renovation and a total urban street green space area of 13.3 ha.

76. **Component 2: Sponge city infrastructure transformation.** This project involves six urban drainage zones: Yitong River, Liao River, Pangxiogou River, South Ring Water System, Qingshui River and Zhaoquan River. This project intends to complete the rainwater and sewage diversion renovation project within the urban area, including a total of about 91.5 km of new rainwater pipes and about 39.4 km of new sewage pipes construction, 1,046 m of new culverts and 60 m of new open channels; it is proposed to build 9 new pumping stations, reconstruct 3 pump station and replace the main facilities and equipment of 47 pumping stations, and add three 5000 m³ regulating and storage tanks and one 3000 m³ regulating and storage tank. In addition, this project also involves one new roads with a total length of 760 m.

77. **Component 3: Digitalization of urban drainage management system.** This component includes digitalization of urban drainage management system, integration of management of drainage facility assets and drainage household information, and construction of drainage facility three-dimensional visualization, grid-based inspection and maintenance, dynamic operation monitoring and early warning, and joint dispatch modules.

78. **Component 4: Capacity building.** This component will establish and hire a project implementation management team to assist the project management office (PMO), PIU to manage projects in accordance with AIIB policies and rules; technical training for management personnel and technical personnel and management personnel of stakeholders on AIIB policies and related fields will be carried out; In addition, field visits and study in domestic demonstration projects or demonstration cities and pilot cities will be provided. This component will enhance the management and technical service capabilities of management personnel and technical personnel of relevant stakeholders.

79. The detailed construction plans of each subproject see below.

3.2 Component 1: Wetland restoration and conservation project

80. Component 1 is "Wetland Restoration and Conservation Project", which covers four areas including urban drainage canals connection, ecological wetland restoration, ecological shorelines, urban ecological green space, a total of 16 sub-projects (Figure 3-1). The bill of quantities of activities of

component 1 are shown in the table below. The overall idea is to open up urban drainage channels, repair the existing urban wetland parks, rebuild the riverbank habitats, increase riparian vegetation, to form an urban green ecological corridor, and build urban ecological green islands.

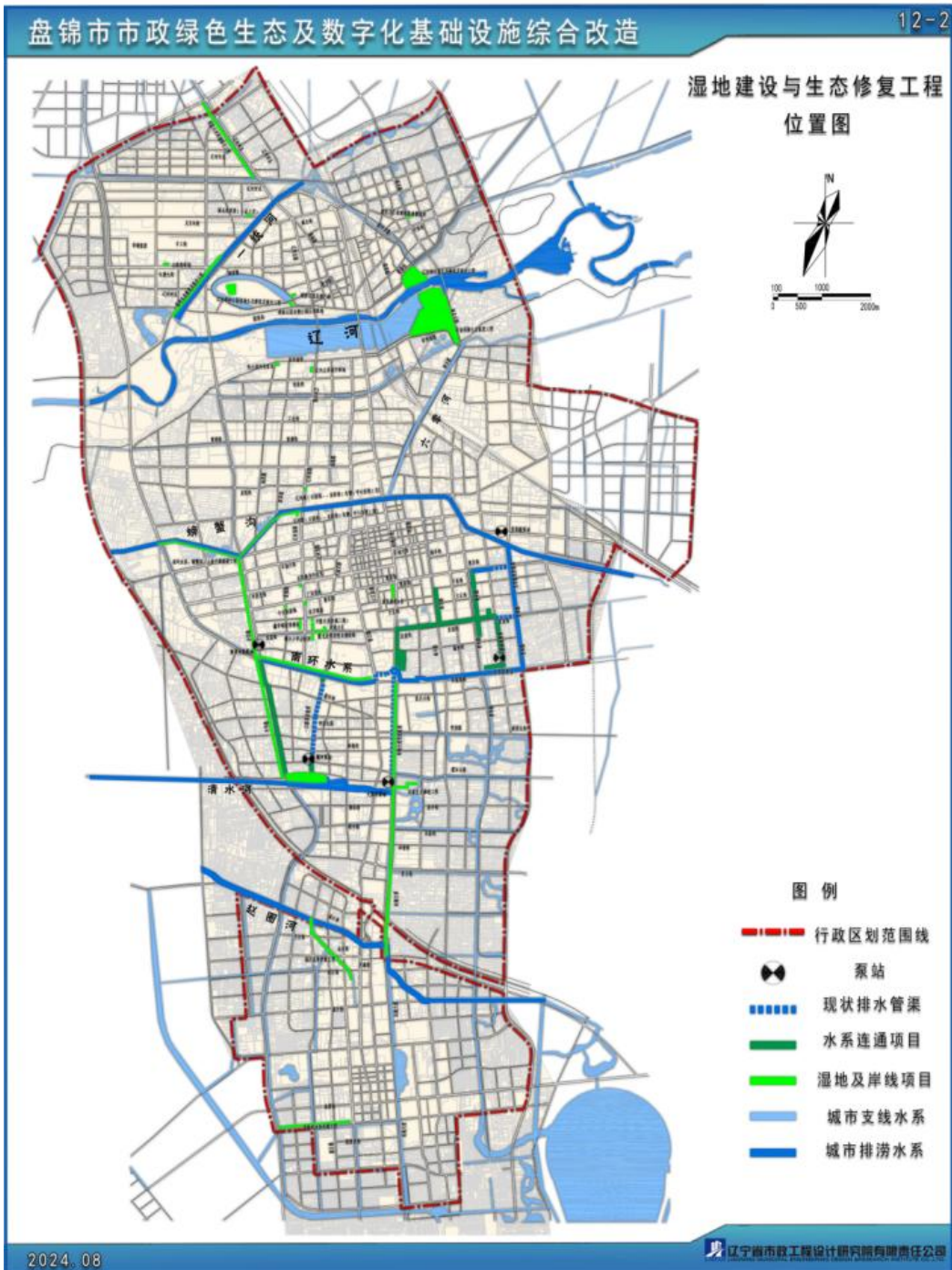


Figure 3-1 Layout of Wetland Restoration and Conservation Project

Source: Feasibility Study Report, October 2024

Table 3-1 Construction Scope of Wetland Restoration and Conservation Project

Urban drainage canals connection
1 Yangjia Canal Wetland Park Construction subproject

Chapter 3 Project Description

N o.	Project Name	unit	quantity	Notes
1	Renovation area of Wetland Park	m ²	95,000	
2	Ecological dredging	m ³	12,000	
3	Replanting of vegetation	pcs	8,700	
4	Replanting area	m ²	18,000	Planting wetland aquatic plants
2 Yijiang Road Water System Connection subproject				
N o.	Project Name	unit	quantity	Notes
1	New stormwater pipes	m	100	
2	Renovation of culverts	m	400	
3	Pumping Station	pcs	1	Demolition of original pump station and construction of a new rainwater pump station
4	Broken Road Recovery	m	100	
3 Zhonghua Road Drainage Channel subproject				
N o.	Project Name	unit	quantity	Notes
1	New culverts	m	900	
2	Renovation of open channel	m	2,500	
3	Bridges	pcs	7	
4	Broken Road Recovery	m	900	
4 Youyi Street Water System Connection subproject				
N o.	Project Name	unit	quantity	Notes
1	Ecological dredging	m ³	10,763.9	
2	New stormwater pipes	m	2,412	
3	Open channel renovation	m	3,804	
5 Shihua Road South Section (Youyi Street-Huancheng South Street) Rainwater Pumping Station and Supporting Project				
N o.	Project Name	unit	quantity	Notes
1	New sewage pipeline	m	1,420	
2	New stormwater pipes	m	2,330	
3	Pumping Station	pcs	1	a new stormwater pumping station
4	bridges	pcs	1	
5	New roads	pcs	1	
Urban ecological wetland restoration				
6 Liaohe Sluice Park Ecological Restoration and Improvement Project				
N o.	Project Name	unit	quantity	Notes
1	Renovation area of Wetland Park	m ²	115,000	
2	Replanting of vegetation	pcs	3,500	
3	Replanting area	m ²	11,300	6,300 m ² of shrubs and 5000 m ² of perennial herbaceous flowers
7 Liaohe Stele Forest Park Wetland Ecological Restoration and Improvement Project				
N o.	Project Name	unit	quantity	Notes
1	Renovation area of Wetland Park	m ²	9,100	
2	Ecological dredging	m ³	9,500	
3	Replanting of vegetation	pcs	450	
4	Replanting area	m ²	6,600	5,200 m ² of wetland aquatic plants
5	Slope protection	m	550	

Chapter 3 Project Description

8 Tianjia Ecological Corridor Subproject					
No.	Project Name	unit	quantity	Notes	
1	Renovation area of Wetland Park	m ²	173,500		
2	Ecological dredging	m ³	117,750		
3	Replanting of vegetation	pcs	8,300		
4	Replanting area	m ²	95,500		
5	Slope protection	m	22,800		
9 Hundred-acre lotus pond ecological restoration subproject					
No.	Project Name	unit	quantity	Notes	
1	Renovation area of Wetland Park	m ²	1,200,000		
2	Replanting of vegetation	pcs	2,750		
3	Replanting area	m ²	25,000	15,000 m ² of wetland aquatic plants	
4	Slope protection	m	1,200		
Ecological shoreline improvement					
10 Yitong River Ecological Restoration and Improvement Subproject					
No.	Project Name	unit	quantity	Notes	
1	Replanting of vegetation	pcs	4,294		
2	Replanting area	m ²	14,030		
3	Shoreline slope protection	m	1,600		
11 Greening subproject on both sides of Goupan Canal					
No.	Project Name	unit	quantity	Notes	
1	Replanting of vegetation	pcs	4,300		
2	Replanting area	m ²	38,000		
3	Shoreline slope protection	m	2,200		
12 Urban North Drainage Slope Protection Subproject					
No.	Project Name	unit	quantity	Notes	
1	Replanting area	m ²	10,500	6,300 m ² of aquatic plants	
2	Shoreline slope protection	m	2,100		
13 South Ring Water System, Pangxiogou River, Shangfang Shoreline Improvement Subproject					
No.	Project Name	unit	quantity	Notes	
1	Greenway	m	13,500		
14 Shuangqiao Street Water System Connection Subproject					
No.	Project Name	unit	quantity	Notes	
1	Open channel renovation	m	1,987		
Urban Greenspace					
15 Urban Ecological Greenspace Construction Subproject (Shuangtaizi District)					
No.	Project Name	unit	quantity	Notes	
1	which	Greenspaces	pcs	7	
		Area	m ²	31,429	
16 Urban Ecological Greenspace Construction Subproject (Xinglongtai District)					
No.	Project Name	unit	quantity	Notes	
1	which	Greenspace	pieces	14	

	Area	m ²	101,599	
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3.2.1 Urban Drainage Canal Connection subproject

81. Due to the insufficient drainage capacity of the drainage system in the main urban area of Panjin City, it cannot meet the drainage needs of the existing drainage facilities in the basin. The Qingshuihe River can meet the drainage needs and has spare capacity. However, the river systems are not connected to each other and cannot effectively adjust the flow. When a large rainfall occurs in a short period of time, there is a high risk of waterlogging. Therefore, this project will connect the natural water bodies by adding drainage channels, building pump stations and pipelines, and combining widening or repairing the original river channel to achieve the connection of the water system of Pangxieyou River -Huancheng Water System-Qingshuihe River, relieve the drainage pressure of Pangxieyou River, and eliminate the surrounding waterlogging.

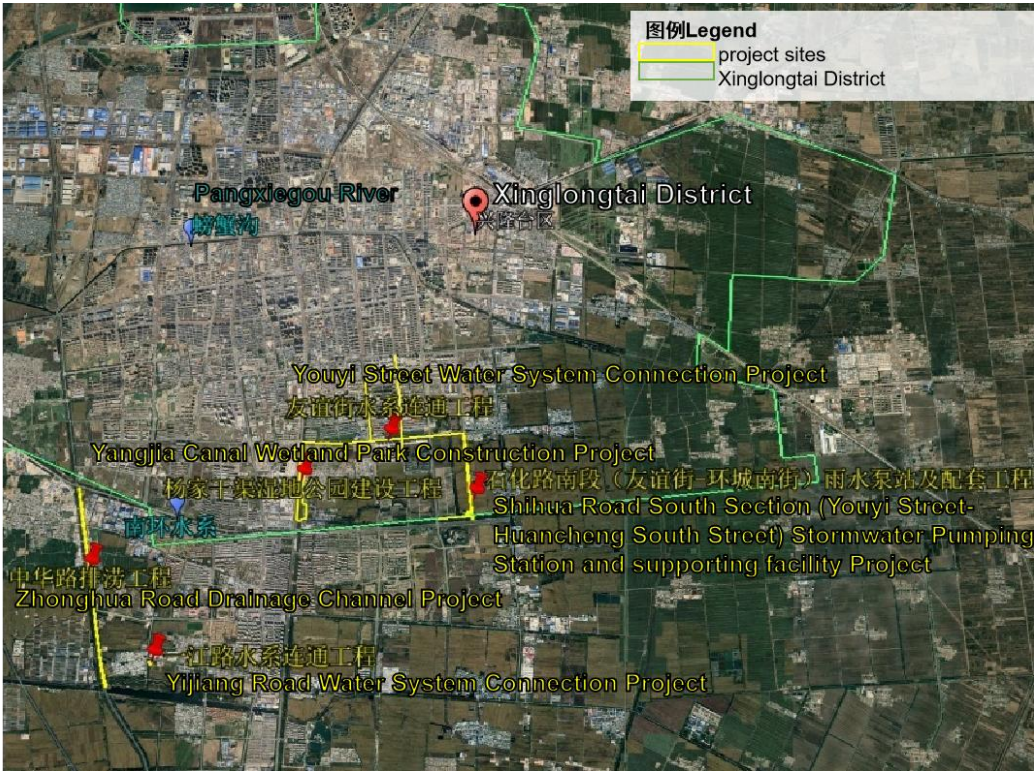
82. The connection route of the subproject (Figure 3-2) is from Pangxieyou River through the Fangcao Road pump station, flows to the Youyi Street drainage channel, passing through the Yangjia Canal wetland, through the new pump station, along the existing culvert of Xianghai Avenue; and flows to the Qingshui River. The collected stormwater from Huancheng water system flows along the Zhonghua Road and Yijiang Road drainage channels and flows to the Qingshui River; The stormwater pump station and supporting projects of the southern section of Shihua Road (Youyi Street-Huancheng South Street) will collect stormwater from the Shihua Road pump station along the Huancheng water system through the existing canal of Xianghai Avenue and flows to the Qingshui River.



Source: Project Feasibility Study Report, August 2024

Figure 3-2 Diagram of Urban drainage system connectivity

83. The urban drainage canal connection subproject includes 5 projects: (1) Yangjia Canal Wetland Park Construction Project; (2) Yijiang Road Water System Connection Project; (3) Zhonghua Road Drainage Channel Project; (4) Youyi Street Water System Connection Project; (5) Shihua Road South Section (Youyi Street-Huancheng South Street) Stormwater Pumping Station and supporting facility Project.

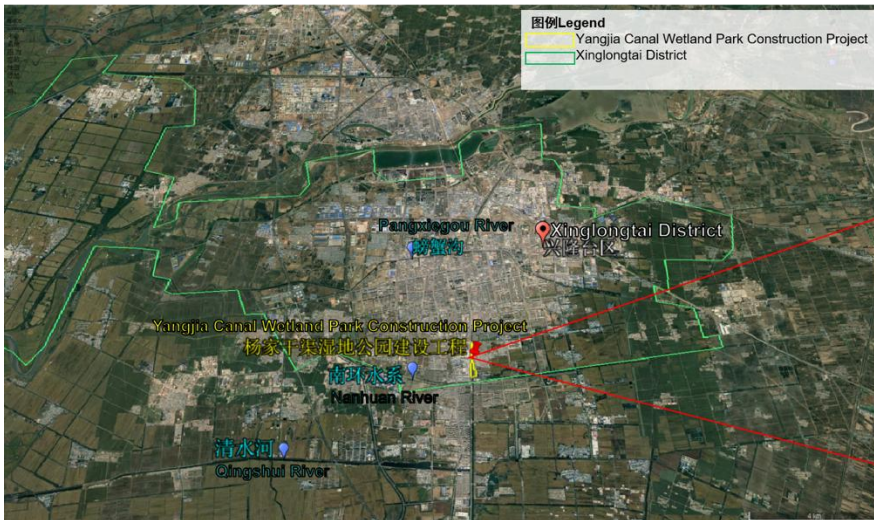


Source: ESIA Unit, November 2024

Figure 3-3 Location of urban drainage canals connection subproject

3.2.1.1 Yangjia Canal Wetland Park Construction subproject

84. The Yangjia Canal Wetland Park subproject is located in Xinglongtai District, Panjin City, Liaoning Province, which is on the east side of Xianghai Avenue, from the Yangjia Canal sluice to Youyi Street, with a length of 1,200 meters, an average width of 60 meters, and a maximum width of 135 meters on the south side, the current situation is canals.



Source: ESIA unit, November 2024

Figure 3-4 Location and current situation of Yangjia Canal Wetland Park subproject

85. The project covers an area of 95,000 m² and plans to carry out ecological dredging (See the Glossary table) of the river for 12,000m³, build a wetland park along the riverbank, plant 18,000m² of wetland aquatic plants, and add recreational facilities such as hydrophilic platforms.

Table 3 - 2 Construction Quantity of Yangjia Canal Wetland Park Construction Project

Yangjia Canal Wetland Park Construction Project				
No.	Project Name	Quantity	unit	Notes
1.1	Ecological dredging	12,000	m ³	24,000 m ² of dredging area for original pond, with a depth of 0.5 m.
1.2	Wetland preparation excavation	28,800	m ³	
1.3	Wetland filling	35,200	m ³	Micro-topography
1.4	Base soil	7,000	m ³	5 to 10m around water bodies ; thickness is 0.3m
2 Hard landscape engineering				
2.1	Sponge Square	2,200	m ²	
2.2	Sponge garden path	4,300	m ²	
2.3	Pier and water platform	550	m ²	Wooden, with a length of 180m, a length of width 2.4m ; area of single platform is 20~ 30 m ²
2.4	Landscape structures	26	pcs	Pavilion, corridor, flower stand, landscape wall
2.5	Small Landscape Sculpture	45	pcs	Customization
2.6	Sports and fitness equipment	60	set	Finished product purchase
2.7	Children's Activities facilities	8	set	Finished product purchase
2.8	Landscape Stone	320	m ³	
3 Ecological greening project				
3.1	Tree planting	5,500	pcs	
3.2	Sub-tree planting	3,200	pcs	
3.3	Shrub planting	18,000	m ²	
3.4	Ground cover planting	12,000	m ²	
3.5	Planting wetland aquatic plants	18,000	m ²	Plant emergent plants such as reed, lotus, loosestrife, calamus, and water plantain, floating leaf plants such as water lily, Victoria amazonica, and Euryale ferox, and submerged plants such as Vallisneria and Dermatophylla.
4	Supporting projects			Lighting system ; Monitoring system ; Urban furniture ; Signage system

3.2.1.2 Yijiang Road Water System Connection Project

86. The Yijiang Road Water System Connection Project is located on Yijiang Road, Xinglongtai District, Panjin City, Liaoning Province, with existing underground channels; there are existing open channels from the Quanhe Pumping Station to the Qingshui River section.



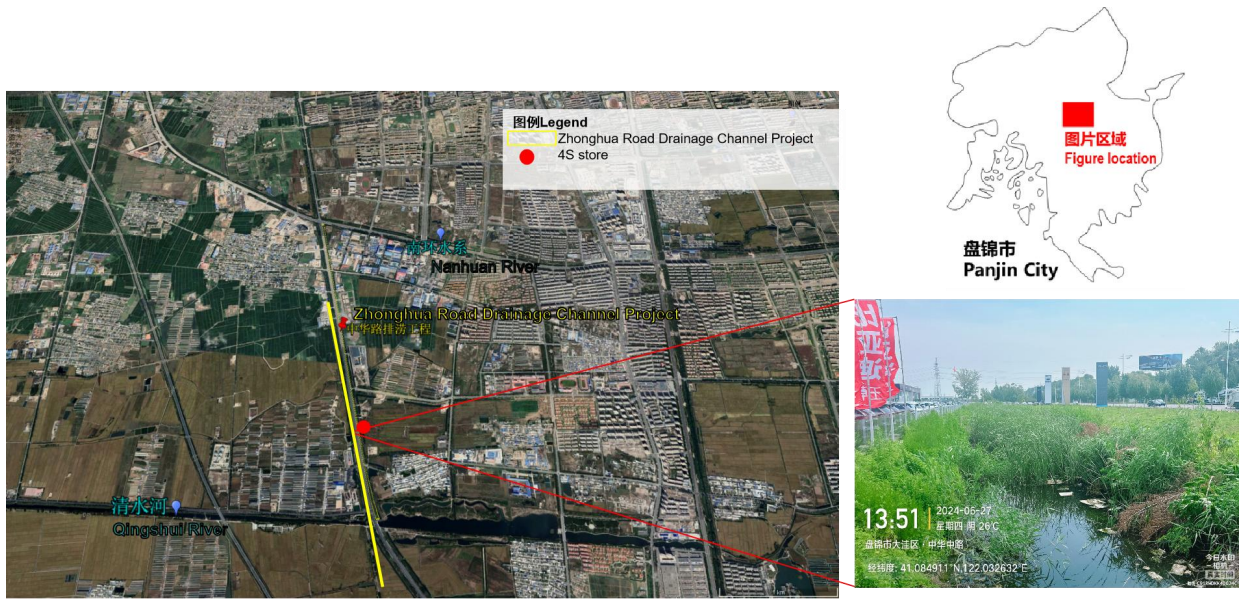
Source: ESIA unit, November 2024

Figure 3-5 Location and current situation of the Yijiang Road water system connection project

87. This project will build a new stormwater pipeline from the north end of Yijiang Road to Huancheng South Street, with a length of 100m. The pipeline laying process involves the restoration of the motor vehicle lane, and the length of the road damage restoration is 100m. Construction support and dewatering will be carried out during the excavation process; the existing open channel from Quanhe Pump Station to Qingshui River will be transformed into a stormwater underground channel, a total of 400m; the existing Quanhe Pump Station will be demolished, and a stormwater pump station will be built on the original site, with a designed flow rate of 7.2m³/s.

3.2.1.3 Zhonghua Road Drainage Channel Project

88. The Zhonghua Road drainage channel project subproject is located on Zhonghua Road, Xinglongtai District, Panjin City, Liaoning Province, and consists of two parts: (i) the construction of a new stormwater culvert of 900 m on Zhonghua Road (from Huancheng South Street to 4S Store Road). The construction process involves the restoration of the motor vehicle lane of the main road, with a total length of 900 m; (ii) Along Zhonghua Road (4S Store to Qingshuihe Road section), the existing canal will be used to transform the open stormwater channel with a total length of 2,500 m. A total of seven 2×13 m prestressed concrete simply supported hollow slab bridges will be built along the open channel.

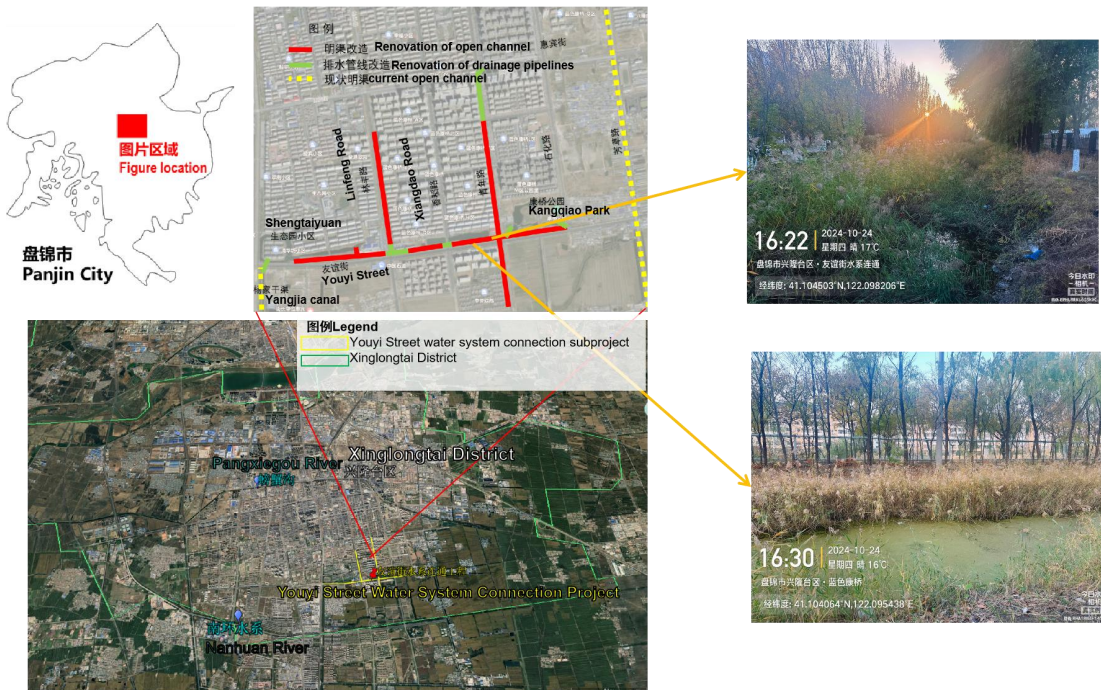


Source: ESIA Unit, November 2024

Figure 3-6 Location and current situation of the Zhonghua Road drainage channel project

3.2.1.4 Youyi Street water system connection subproject

89. The Youyi Street Water System Connection Project is located at Youyi Street, Qingnian Road and Linfeng Road in Xinglongtai District, Panjin City, with a total length of 6.5km. The current situation is all surface water with soil slope and small flow volume, there is a lot of garbage and debris in the river, and the street culvert is relatively silted.



Source: ESIA unit, November 2024

Figure 3-7 Location and current situation of the Youyi Street Water System Connection Subproject

90. The subproject plans to construct new pipelines of 2,412 meters long with a diameter of DN1500; the existing natural drainage ditches will be transformed into open channels with a total length of 3804 m, and the dredging volume is 10763.9 m³. Ecological gabion slope protection of 17760 m² will be built along the bank. The slope is greened with a total greening area of 112500 m², and leisure facilities are added.



Source: Project Feasibility Study Report, August 2024

Figure 3-8 Intended image after river channel construction

Table 3-3 Main contents of the Youyi Street water system connection subproject

Youyi Street water system connection subproject				
No.	Engineering	Quantity	unit	Notes
1	Hard landscape engineering			
1.1	Sponge garden path	15000	m ²	The road width is 2m, located on the 10m wide side, and will be arranged along the entire line
1.2	Recreation Area	150	m ²	Each 10 square meters, located on a 10-meter wide side, with a spacing of 500 meters
1.3	Lounge Seats	15	set	In Rest area, 2-3 seats per set
2	Ecological greening			
2.1	Sub-tree planting	1320	pcs	
2.2	Shrub planting	14500	m ²	
2.3	Ground cover planting	33740	m ²	Including perennial flowers and lawns
3	Ecological slope protection			
3.1	Excavation	29862	m ³	
3.2	Dredging	10763.9	m ³	
3.3	Grass Grid	17835.2	m ²	
3.4	Grass seeds	17835.2	m ²	10-15 grams per m ²
3.5	Ecological gabion slope protection	17760	m ²	
4	channel			
4.1	Open channel 4m*2m	2818	m	Natural groove flat, non-hardened
4.2	DN1500 pipeline	2412	m	Reinforced concrete
4.3	Open channel 15*2	986	m	Natural groove flat, non-hardened
4.4	Gate DN1500	8	pcs	cast iron

3.2.1.5 Shihua Road South Section (Youyi Street ~ Huancheng South Street) Stormwater Pumping Station and Supporting Project

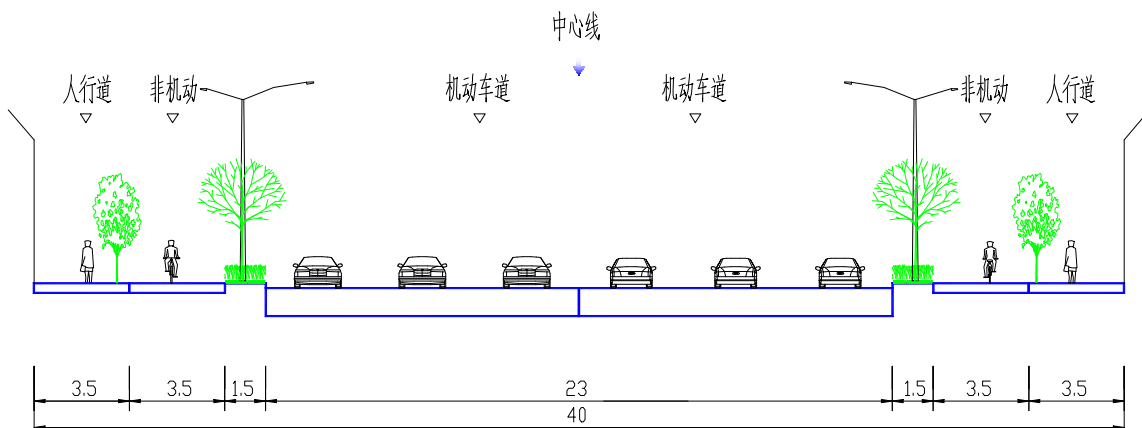
91. This project is located in the eastern part of Xinglongtai District, Panjin City, starts from Huancheng South Street in the south and ends at Youyi Street in the north. The current status is undeveloped farmland of a state-owned farm.



Source: ESIA Unit, November 2024

Figure 3 -9 Project location map and current status map

92. It is planned to build a north-south secondary trunk road with a total length of 1481m and a road red line width of 40m, and construct new stormwater pipelines with a length of 1680m and new sewage pipelines with a length of 1420m; construct new stormwater drainage pump station with a civil engineering capacity of 8m³/s and a total equipment flow of 3.9m³/s; construct new stormwater pipelines with a length of 650m on the Waihuan South Road (Qiannian Street~Shihua Road).



Source: Project Feasibility Study Report, August 2024

Figure 3-10 Shihua Road Section

Table 3 -4 Main contents of stormwater pump station and supporting projects in the southern section of Shihua Road (Youyi Street to Huancheng South Street)

Shihua Road South Section (Youyi Street ~ Huancheng South Street) stormwater Pumping Station and Supporting Project					
No.	name		unit	quantity	Note
1	South section of Shihua Road (Youyi Street to South Huancheng Street)				
(1)	Reinforced concrete pipe stormwater network	d1800	m	600	
		d2200	m	1080	
(3)	Eight-shaped outlet d2200		pcs	2	
(4)	Reinforced concrete pipe sewage network	d500	m	200	
		d600	m	600	
		d800	m	620	
		Road length	m	1481	
(5)	New secondary road	Width of motorway	m	23	
		Sidewalk Width	m	7	
		Green belt width	m	3	
		Non- motorized vehicle lane width	m	7	
2	Huancheng South Road (Qingnian Street ~ Shihua Road)				
(1)	Reinforced concrete pipe d1500 stormwater pipe network		m	650	
(2)	Inverted Siphon 2mX2m		m	80	
3	New stormwater pumping station		pcs	1	Civil engineering 8m ³ /s, total equipment flow 3.9m ³ /s)
(1)	Submersible axial flow pump		pcs	3	1.3m ³ /s, H=8m, N=250kW
4	New bridge		pcs	1	
(1)	length		m	52	
	width		m	40	

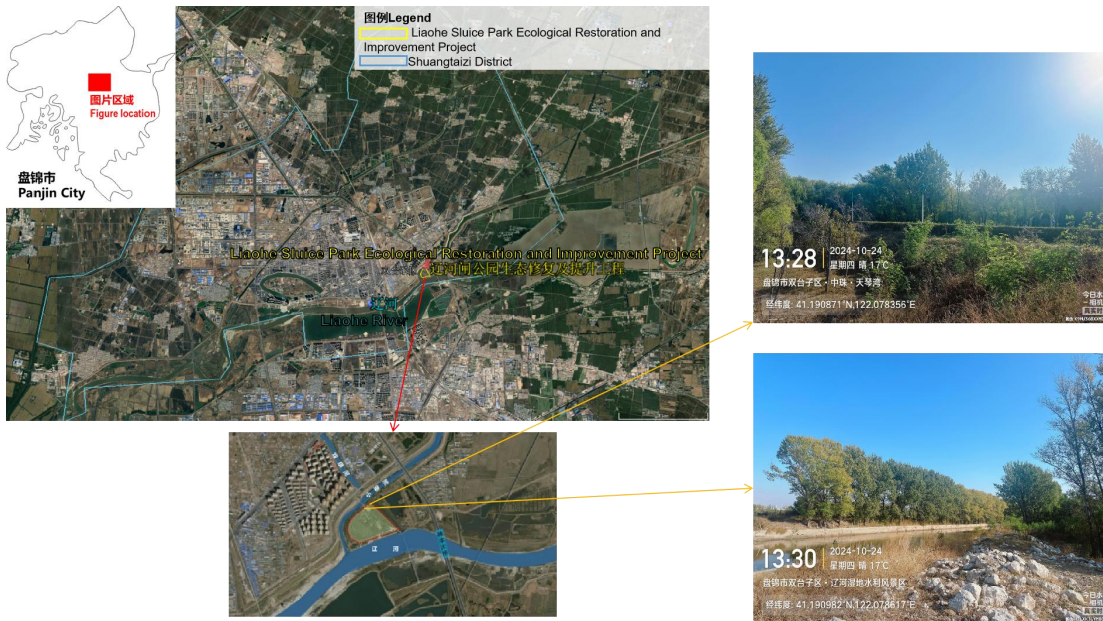
3.2.2 Ecological Wetland Restoration Project

93.This project will restore the existing urban waterfront wetlands in Shuangtaizi District, Xinglongtai District and Dawa District of Panjin City: (i) Liaohe Sluice Park ecological restoration and improvement project; (ii) Liaohe Forest of Steles Park wetland ecological restoration and improvement project; (iii) Tianjia Ecological Corridor Project; (iv) Hundred-acre lotus pond ecological restoration project.

94.The total area of restoration is 149,7600 square meters, the total amount of dredging is 127,250m³, a total of 15,000 plants are planted, a total of 1750m of ecological revetments are built, and a total of 22.8km of ecological slope protection is built. The wetland restoration involved in this project is all urban wetlands,and does not involve important wetlands and key habitats.

3.2.2.1Liaohe Sluice Park Ecological Restoration and Improvement Project

95.The ecological restoration and improvement project of Liaohe Sluice Park is located in Liaohe Sluice Park, Shuangtaizi District, Panjin City. Liaohe Sluice Park is currently an urban waterfront park open to the public, and the existing vegetation is mainly locust trees.



Source: ESIA Unit, November 2024

Figure 3 - 11 Satellite map of the ecological restoration and improvement area of Liaohe Sluice Park

96.The renovation area is about 115,000 square meters. The renovation area of this project is about 115,000 square meters. This project intends to cut down the original trees in the areas with over-old trees, diseases and high density, that is, thinning in the original forest, a total of 900 trees, and replant 3,500 trees in the areas outside the river that lack green coverage and the empty locations of the original forest thinning ; carry out bird habitat restoration, preserve and restore the river ecosystem, preserve or build natural tree holes, branch piles and rock crevices for birds to build nests ; carry out the construction of leisure parks incorporating the sponge concept, and use permeable bricks and permeable concrete in the square, set up rain gardens, sunken green spaces, etc.

Table 3-5 Bill of quantities of the Liaohe Sluice Park Ecological Restoration and Improvement Project

Liaohe Sluice Park Ecological Restoration and Improvement Project				
No.	Project Name	Project Quantity	unit	Note
1	Ecological greening project			
1.1	Tree replanting (Ø12-15cm)	800	pcs	Lack of green areas outside the river
1.2	Tree replanting (Ø8-10cm)	1,200	pcs	Lack of green areas outside the river
1.3	Sub-tree replanting (D6-8cm)	1,500	pcs	Lack of green coverage outside the river; empty areas in the original forest
1.4	Shrub replanting	6,300	m ²	There is a lack of green coverage outside the river; the current edge of the forest
1.5	Perennial Herbaceous Flowers	5,000	m ²	Roadside; edge of woods
1.6	Untouched forest thinning	900	pcs	Trees that are too old; sick trees; areas with too much canopy density
2	Supporting projects			
2.1	Reconstruction of sponge-shaped square	2,800	m ²	Permeable ground
2.2	New sponge-type garden road	1,800	m ²	Permeable ground
2.3	Patrol station and warehouse maintenance	340	m ²	Roof and exterior wall repair; interior repair

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2.4	Lounge Seats	120	pcs	Finished product purchase
2.5	Trash can (sorting)	80	pcs	Finished product purchase
2.6	Patrol road maintenance	8,000	m ²	



Figure 3-12 Liaohe Sluice Park Ecological Restoration and Improvement Intention Map

Source: Project Feasibility Study Report, August 2024

3.2.2.2 Liaohe Steles Park Wetland Ecological Restoration and Improvement Project

97. The Liaohe Stele Park Wetland Ecological Restoration and Improvement Project is located in the western part of the Liaohe Stele Forest Park in Shuangtaizi District, Panjin City. The current situation is a natural pond, covering an area of about 9,100 square meters.



Source: ESIA unit, November 2024

Figure 3-13 Location and current situation of Liaohe Stele Forest Park Wetland Ecological Restoration and Improvement

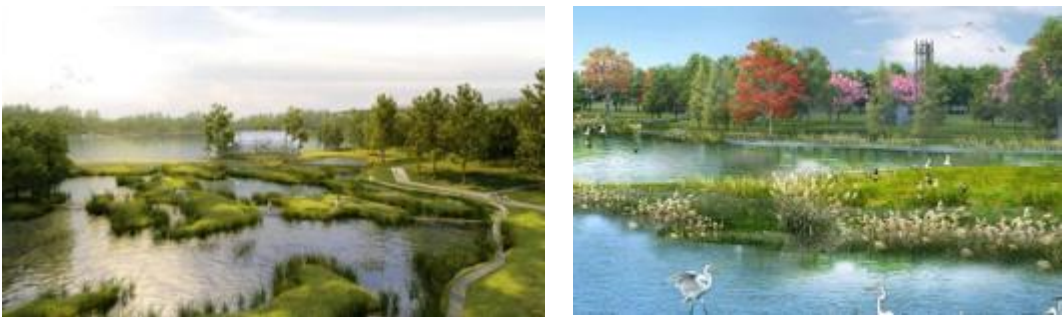


Figure 3-14 Liaohe Stele Forest Park Wetland Ecological Restoration and Improvement Intention Map

Source: Project Feasibility Study Report, August 2024

98. It will conduct ecological dredging of 9,500 m³ for existing ponds, conduct 6,200 m³ of excavation for land reclamation, carry out 7,800 m³ of filling, and 2,700 m³ of matrix soil with a thickness of 0.3 meters will be laid. The total vegetation planting area is 6600 m², and 450 plants will be planted. Ecological revetments will be built along the coast, with a total length of 550m.

Table 3 -6 Liaohe Stele Forest Park wetland ecological restoration and improvement project

Liaohe Forest of Steles Park Wetland Ecological Restoration and Improvement Project				
No.	Project Name	Project Quantity	unit	Note
1	Earthworks			
1.1	Ecological dredging	9500	m ³	Current status of ponds
1.2	Terrain adjustment cut	6200	m ³	
1.3	Land reclamation and filling	7800	m ³	Micro-topography
1.4	Base soil	2700	m ³	Thickness 0.3m
2	Planting Project			
2.1	Planting wetland aquatic plants	5200	m ²	
2.2	Tree planting	450	pcs	
2.3	Shrub planting	1400	m ²	
3	Supporting projects			
3.1	Ecological revetment construction	550	m	
3.2	Reconstruction of sponge-shaped square	1600	m ²	Wetland surrounding plaza
3.3	Reconstruction of sponge-shaped garden roads	3400	m ²	Wetland surrounding garden path
3.4	Pier and water platform	288	m ²	Wooden, length 120m, width 2.4m

3.2.2.3 Tianjia Ecological Corridor Project

99. The Tianjia Ecological Corridor Project is located in Dawa District, Panjin City, and consists of two parts: (i) The ecological wetland on the east side of the Yangjia Canal, from the Nanyang Secondary Water Lifting Station on the south side of the Danxi Expressway to the north to the Nanhuan Road, with a length of 7,600 meters, and an area of 136,000 square meters; (ii) The Xiaoqinghe River Ecological Wetland, from the east side of the Yangjia Canal to the south side of the Huotian Highway, with a total length of 750 meters, and an area of 37,500 m².

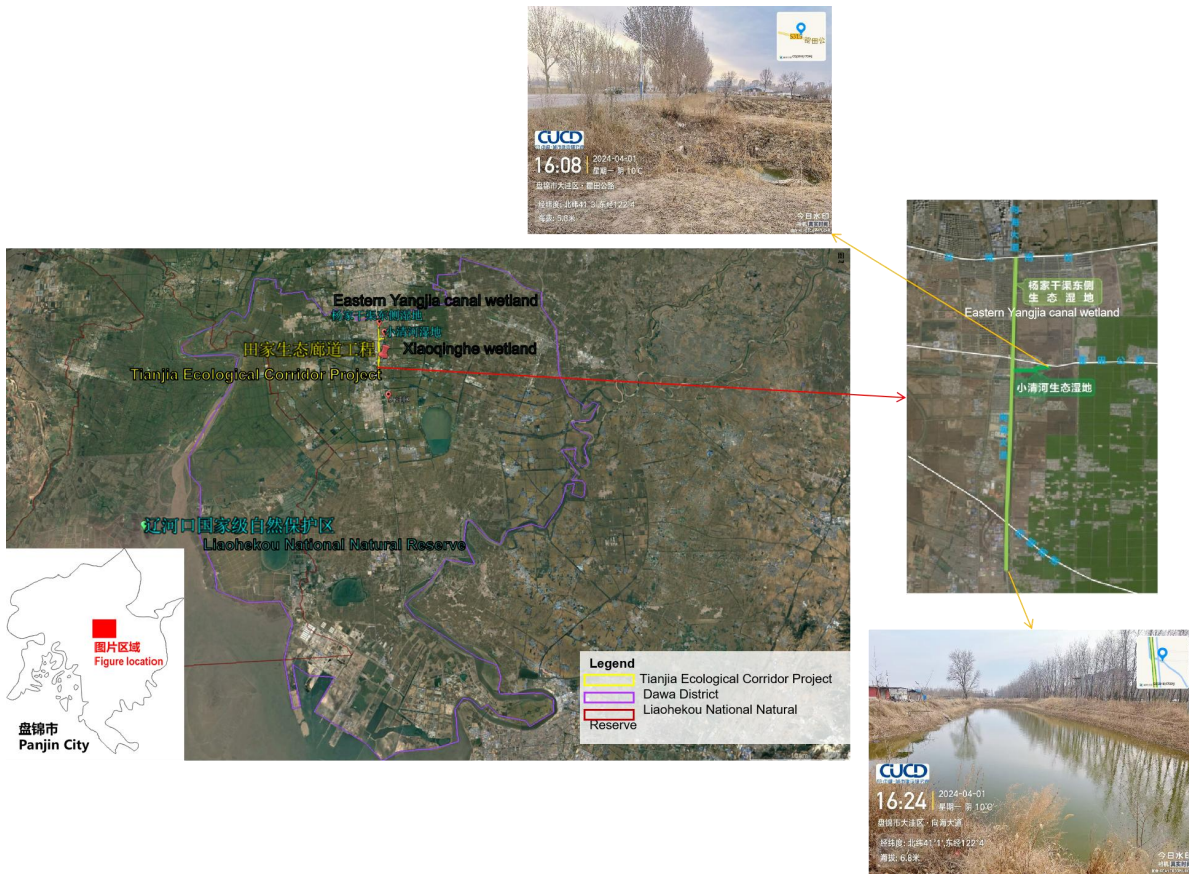


Figure 3-15 Location and current situation of Tianjia Ecological Corridor Project

Source: ESIA unit, November 2024

100. The east side of Yangjia Canal engineering will carry out renovation of the existing 7.6km-long canal, with excavation volume of 114,000 m³, forming a main waterway with a width of 10m and a depth of 1.5m; it will plant emergent plants, covering an area of 18,000 m².

101. The terrain is shaped and shrubs and ground cover plants are planted in the 8-meter space from the west side of the main waterway to the foot of the slope, covering a total area of 55,000 m². Honeycomb three-dimensional geogrid slope protection is set up for the river bank protection; a total of 15.2 km on both sides; ecological slope protection is added within 2 meters on both sides of the original greenway on the west side, using ecological chain lock block slope protection, 7.6 km long; and supporting facilities for leisure parks are added.

102. Restoration of waterfowl habitat: Keep reeds on the land side and remove reeds or *Spartina alterniflora* on the sea side to create open beach and water habitats. Remove reeds by mechanical or manual harvesting, and dig a 1m to 2m wide ditch between deep water and reeds, with the water depth maintained at no less than 2m for a long time.

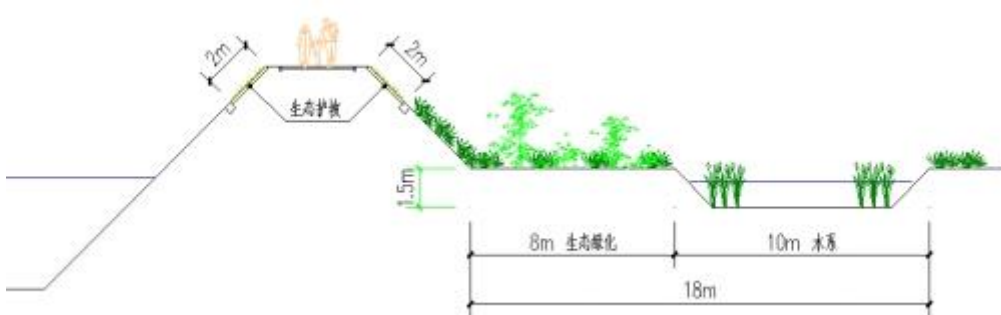


Figure 3-16 The cross-sectional form of the ecological wetland water system on the east side of Yangjia Canal

Source: Project Feasibility Study Report, August 2024



Figure 3-17 The ecological wetland water system intention map on the east side of Yangjia Canal

Source: Project Feasibility Study Report, August 2024

103.The Xiaoqing River Ecological Wetland engineering plans to carry out ecological dredging of the existing water system, totaling 3,750 m³. The excavation volume for wetland preparation is 7,500 m³, and the filling volume is 5,200 m³, which will be used for micro-topography. In addition, the project will plant 4,100 green trees, 15,000m² of shrubs and ground cover plants, 7,500m² of wetland aquatic plants, and add leisure supporting facilities.



Figure 3-18 Intention map of Xiaoqing River

Source: Project Feasibility Study Report, August 2024

Table 3 -7 Bills of Quantities of the Tianjia Ecological Corridor Subproject

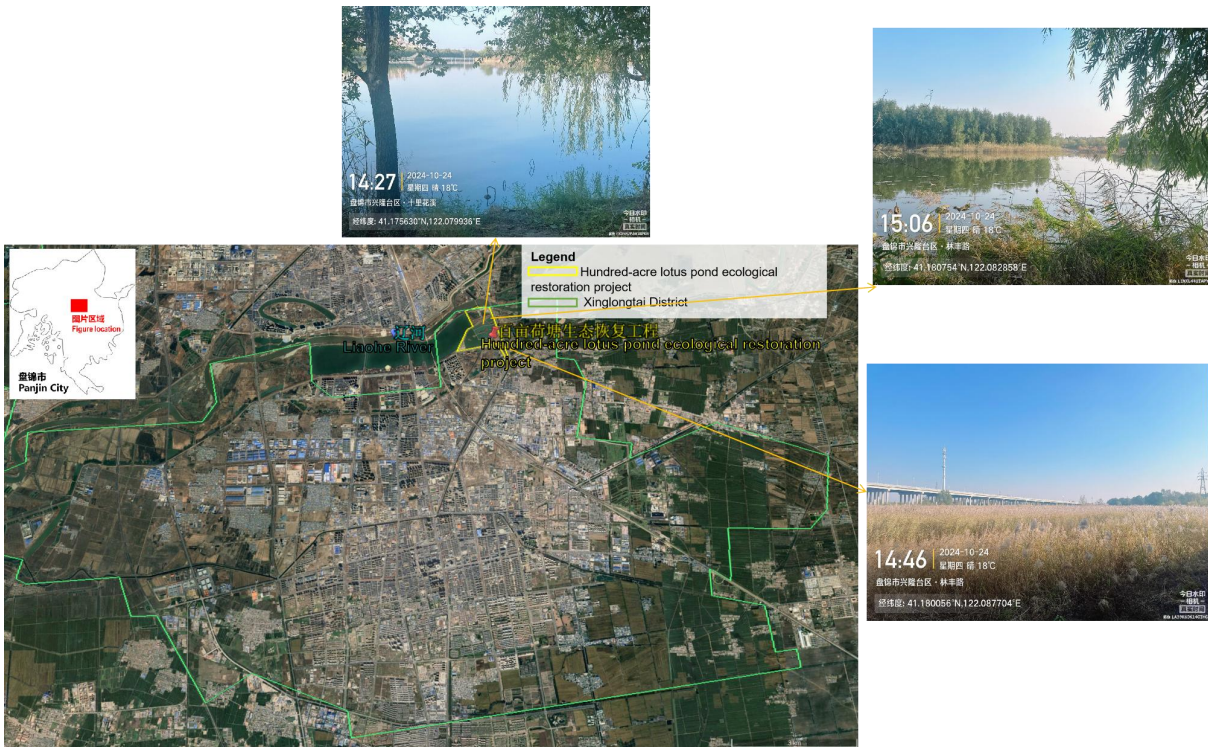
Tianjia Ecological Corridor Project				
(i)	Ecological wetland on the east side of Yangjia Canal			
1	Water system restoration project	Quantity	Unit	Note
1.1	Water system improvement excavation	114000	m ³	The restored river channel is 10m wide, 1.5m deep and 7.6km long.
1.2	Terrain preparation	60800	m ²	8m wide green area
1.3	Water system ecological bank protection	32200	m ²	Honeycomb three-dimensional geogrid slope protection; a total of 15.2km on both sides
1.4	Landscape Stone	550	m ³	
2	Ecological greening project			
2.1	Sub-tree planting	4200	pcs	
2.2	Shrub planting	24000	m ²	
2.3	Ground cover planting	31000	m ²	
2.4	Planting of emergent plants	18000	m ²	
3	Supporting projects			

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3.1	Ecological slope protection	30400	m ²	Ecological interlocking block slope protection; 2m on each side of the greenway, 7.6km long
3.2	Sports and fitness equipment	20	set	Finished product purchase
3.3	Children's Activities	3	set	Finished product purchase
3.4	Lighting system	1	pcs	
3.5	Monitoring system	1	pcs	
3.6	Urban furniture	1	pcs	
3.7	Marking system	1	pcs	
(ii)	Xiaoqing River Ecological Wetland			
1	Earthworks	Quantity	Unit	Note
1.1	Ecological dredging	3750	m ³	
1.2	Wetland preparation excavation	7500	m ³	
1.3	Wetland filling	5200	m ³	Micro-topography
1.4	Base soil	2250	m ³	Aquatic plant planting area; thickness 0.3m
2	Hard landscape engineering			
2.1	Sponge Square	1200	m ²	
2.2	Sponge garden path	1350	m ²	
2.3	Pier and water platform	550	m ²	Wooden, length 180m, width 2.4m; single platform 20~30 m ²
2.4	Landscape structures	12	pcs	Pavilion, corridor, flower stand, landscape wall
2.5	Small Landscape Sculpture	10	pcs	Customization
2.6	Landscape Stone	240	m ³	
3	Ecological greening project			
3.1	Tree planting	2500	pcs	
3.2	Sub-tree planting	1600	pcs	
3.3	Shrub planting	9000	m ²	
3.4	Ground cover planting	6000	m ²	
3.5	Planting wetland aquatic plants	7500	m ²	

3.2.2.4 Hundred-acre lotus pond ecological restoration project

104. The project is located on the west side of Linfeng Bridge on the south bank of Liaohe River in Xinglongtai District, Panjin City, and extends to Yanhe South Street in the south. The current situation is scattered natural ponds, and the shore plants are mainly common greening trees such as willows. Some ponds are open waters, and some ponds are reed communities.



Source: ESIA Unit, November 2024

Figure 3-19 Satellite map of the hundred-acre lotus pond ecological restoration project area

105. The project transforms the existing area into a wetland, adjusts the water system, organizes the terrain, and uses the dredging project to create a reasonable underwater terrain with multiple habitat conditions consisting of land, lakeside area (0-40 cm), shallow water area (40-100 cm), transition area (100-150 cm), and deep water area (above 150 cm). The overall layout is divided into the following areas:

106. Lotus Pond Scenic Area - A large area of aquatic plants such as lotus and water lily are planted to form a spectacular lotus pond landscape. Water-friendly platforms and plank roads are set up in some areas to allow tourists to watch the lotus flowers up close and feel their freshness and beauty.

107. Wetland conservation area - preserve the original wetland vegetation, plant wetland plants such as reeds and calamus, and provide habitats for birds, fish and other creatures. Build ecological observation points to facilitate scientific researchers and tourists to observe changes in the wetland ecosystem.

108. Popular Science Education Area - Popular science signs are set up to introduce the functions, protection significance and ecological value of wetlands.

109. Waterfront leisure area: leisure trails and bicycle paths are set up along the river bank for people to walk and ride. Leisure seats, wooden platforms, plank roads and other facilities are arranged for tourists to rest and enjoy the scenery.



Figure 3-20 Plan of the hundred-acre lotus pond ecological restoration project

Source: Project Feasibility Study Report, August 2024

110. **Earthworks.** The Hundred Mu Lotus Pond Ecological Restoration Project plans to excavate 46,000 cubic meters of wetland for wetland management and fill 25,000 cubic meters of wetland for wetland management. It is planned to backfill 12,500 cubic meters of matrix soil in the aquatic plant planting area with a thickness of 0.3 meters.

111. **Ecological greening project.** The project plans to plant 1,500 trees, 1,250 sub-trees, 4,000 square meters of shrubs, 6,000 square meters of ground cover, and 15,000 square meters of wetland aquatic plants.

112. **Landscape engineering:** This project plans to build an ecological revetment with a length of 1,200 meters and a wooden landscape platform of 800 square meters.

3.2.3 Ecological Shoreline Project

113. The ecological shoreline project will green the landscape along the five artificial canals in Shuangtaizi District, Xinglongtai District and Dawa District of Panjin City, creating an urban riverside green space with a total length of 21.387km, including:

- 1) Yitong River ecological restoration and improvement project;
- 2) Greening project on both sides of Goupan Canal;
- 3) The urban north row slope protection project;
- 4) Nanhuan Water System, Pangxiogou River, and Shangfang Canal Greenway Project;
- 5) Shuangqiao Street water system connection project.

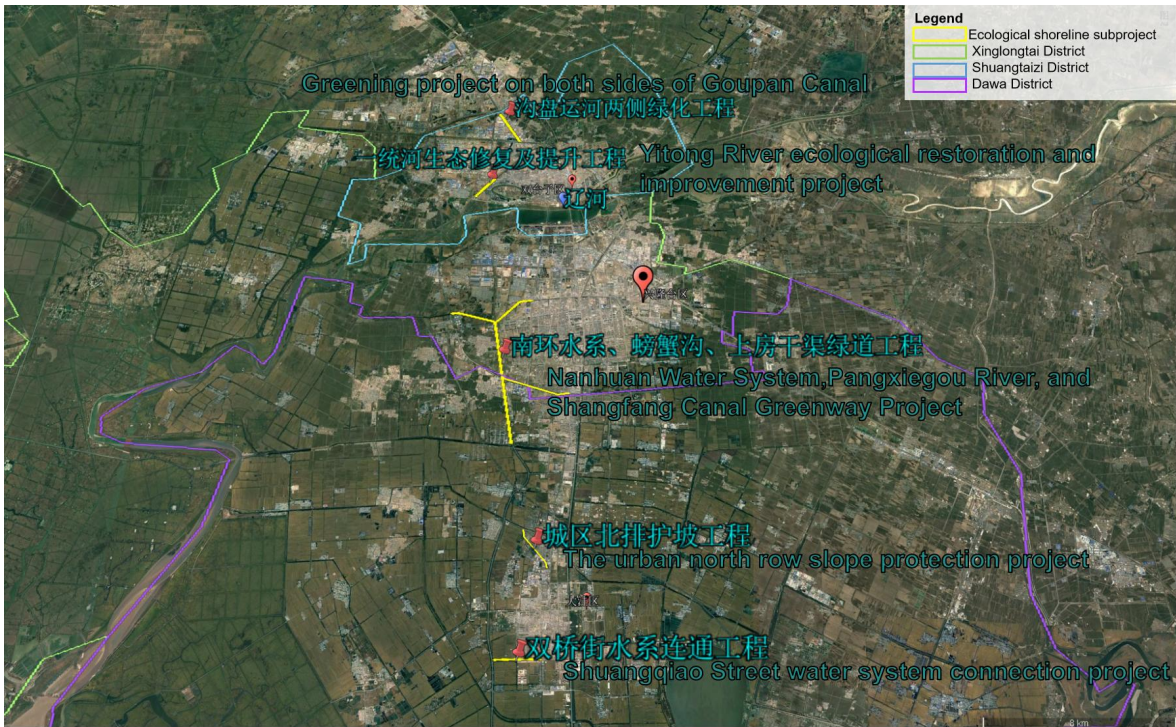


Figure 3-21 Location of Ecological Shoreline Subproject

Source: ESIA unit, November 2024

3.2.3.1 Yitong River Ecological Restoration and Improvement Project

114. This project is located on the north side of Yitong River in Shuangtaizi District, Panjin City, from the Liaohe River entrance on Hongqi Sub-district to Gujia Water Conservancy Management Office, with a total length of 1,600 meters, a width of 5 to 30 meters, and an area of 26,300 square meters. The green landscape of the existing green space will be improved and renovated, and a strip of riverside green space will be created along the available land on the north side of Yitong River.

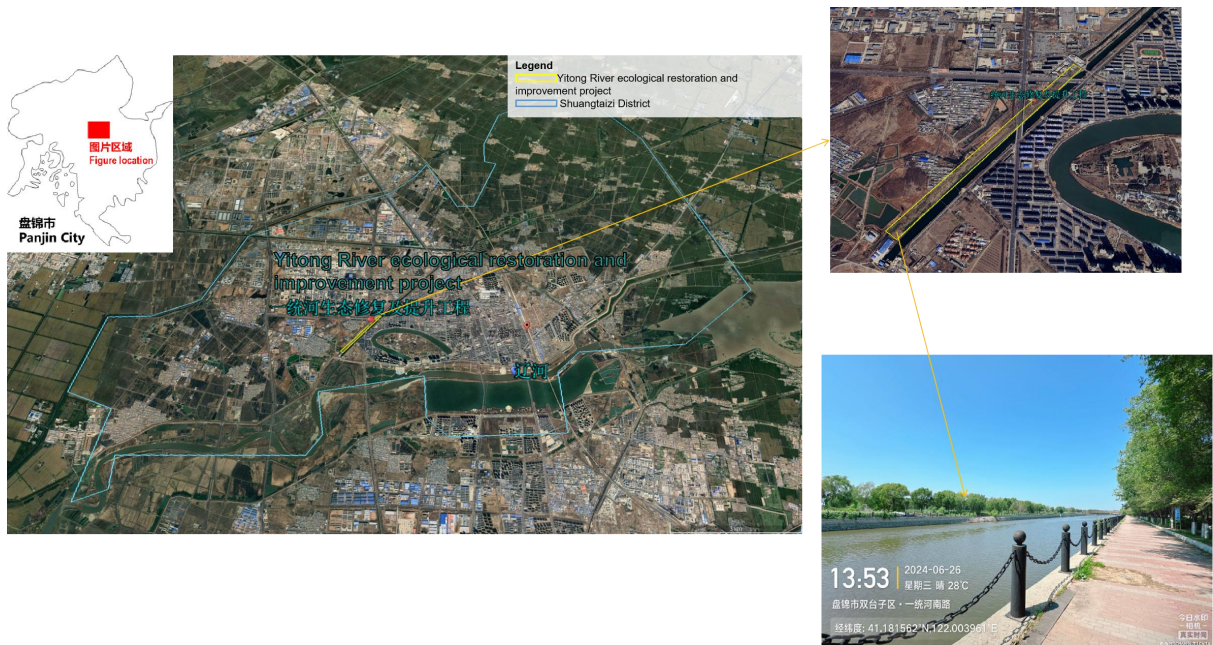


Figure 3-22 Location and current situation of the Yitong River ecological restoration and improvement area

Source: ESIA unit, November 2024

115. **Landscape engineering.** This project will rebuild a sponge-shaped square with an area of 1,850 square meters and a sponge-shaped garden road with an area of 2,250 square meters. In addition, this project plans to set up 4 landscape structures (including pavilions, corridors, flower stands, and landscape walls) and 4 small landscape sculptures.

116. **Ecological greening project:** This project will plant 2,751 trees, 1,543 sub-trees, 1,500 square meters of shrubs, and 12,530 square meters of ground cover.



Figure 3-23 Yitong River ecological restoration and improvement area intention map

Source: Project Feasibility Study Report, August 2024

3.2.3.2 Greening project on both sides of Goupan Canal

117. The project is located in Shuangtaizi District, Panjin City, from Zhonghua Road Bridge to Shuangrao Main Canal on Goupan Canal, with a total length of 2,200 meters. The east side of the canal in the project area is 7 meters, and the west side is an average of 15 meters. Ecological greening is carried out in the design area, and the total area of the project is about 48,400 square meters.



Figure 3-24 Satellite map of the green areas on both sides of the Goupan Canal

Source: Project Feasibility Study Report, August 2024



Figure 3-25 Intended drawing of greening areas on both sides of Goupan Canal

Source: Project Feasibility Study Report, August 2024



Figure 3-26 Greening plan on both sides of the Goupan Canal (partial standard section)

Source: Project Feasibility Study Report, August 2024

(1) Greening project.

118. Greening planting will introduce the concept of sponge city and build low-carbon and breathing green space. According to the growth characteristics of local plants, economically suitable trees and shrubs with different flowering periods and terrain and water bodies are selected to design the landscape. The planting form of trees, shrubs and ground covers is different from the dense planting form in the past. Point planting and scattered planting are adopted to give plants space to grow and achieve a sparse and dense arrangement. It is planned to plant 2,500 trees, 1,800 sub-trees, 15,000 square meters of shrubs, and 23,000 square meters of ground cover plants;

(2) Sponge transformation project and supporting facilities.

119. The project plans to build 12 sponge-type squares with an area of 1,200 square meters, 2,500 meters of sponge-type garden roads with a width of 2 meters and a construction area of 5,000 square meters. The plant planting area will be set up with sunken green spaces in rain gardens and local soil will be paved with organic coverings to provide good water storage functions. It is planned to set up 12 small landscape structures (pavilions, corridors, flower stands) and 15 small landscape sculptures.

3.2.3.3 North Slope Protection Project

120. This project is located in Dawa District, Panjin City, from the gate of Beipai stormwater lifting pump station to the Zhaoquan River drainage direction. This project will transform a stormwater open channel with a length of about 2,100 meters to form a stormwater channel and plant water plants and green plants. The plan adopts ecological slope protection with a construction area of 12,600 square meters. The slope surface is arranged and the material is slope protection interlocking blocks. The single-side slope is 5.8 meters long, and the slope surface is greened and planted. Aquatic plants are planted at the

foot of the slope and shallow water. This project will also plant 4,200 square meters of riparian plants and 6,300 square meters of aquatic plants.

3.2.3.4 Nanhuan Water System, Pangxieyou River, and Shangfang Canal Greenway Project

121. This project is located in Xinglongtai District, Panjin City, and consists of three sections. The northern greenway is located on the south side of Pangxieyou, along Pangxieyou from Huancheng West Road through Zhonghua North Road to Liaohe Middle Road, with a length of 4,200 meters; the north-south greenway is located on the west side of Zhonghua Road, from Xinglongtai Street to Binhai Road, with a length of 6,100 meters; the middle greenway is located on the north side of Huancheng South Road, from Zhonghua Road to Taishan North Road, with a total length of 3,200 meters.



Figure 3-26 Location and current situation of Nanhuan Water System, Pangxieyou River, and Shangfang Canal Greenway area

Source: ESIA unit, November 2024

122. This project will transform the existing gravel trails on both sides of the Nanhuan Water System, Pangxieyou River and Shangfang Canal into ecological greenways.

Table 3-2 Bills of Quantities of Nanhuan Water System, Pangxieyou River, Shangfang Canal Greenway Project

Nanhuan Water System, Pangxieyou River, Shangfang Canal Greenway Project				
(i)	South side of Pangxieyou River (Huancheng West Road via Zhonghua North Road to Liaohe Middle Road)			
1	Hard landscape engineering	Quantity	Unit	Note
1.1	Sponge garden path	8200	m ²	Road width 2m
1.2	Leisure space	2	pcs	Set up leisure seats, vending machines, mobile phone chargers, etc.
1.3	Ecological toilet	2	pcs	
(ii)	West side of Zhonghua Road (from Xinglongtai Street to Binhai Road)			
1	Hard landscape engineering	Quantity	Unit	Note
1.1	Sponge garden path	12000	m ²	Road width 2m
1.2	Leisure space	4	pcs	Set up leisure seats, vending machines, mobile

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				phone chargers, etc.
1.3	Ecological toilet	4	pcs	
(iii)	North side of South Huancheng Road (from Zhonghua Road to Taishan North Road)			
1	Hard landscape engineering	Quantity	Unit	Note
1.1	Sponge garden path	5800	m ²	Road width 2m
1.2	Leisure space	2	pcs	Set up leisure seats, vending machines, mobile phone chargers, etc.
1.3	Ecological toilet	2	pcs	



Figure 3-27 Construction intention

Source: Project Feasibility Study Report, August 2024

3.2.3.5 Shuangqiao Street Water System Connection Project

123. This project is located at Shuangqiao Street in the southern part of Dawa's main urban area, east of Zhonghua Road and west of Hexiang Road. It is a reconstruction of the open stormwater channel with a total length of 1,987 meters.



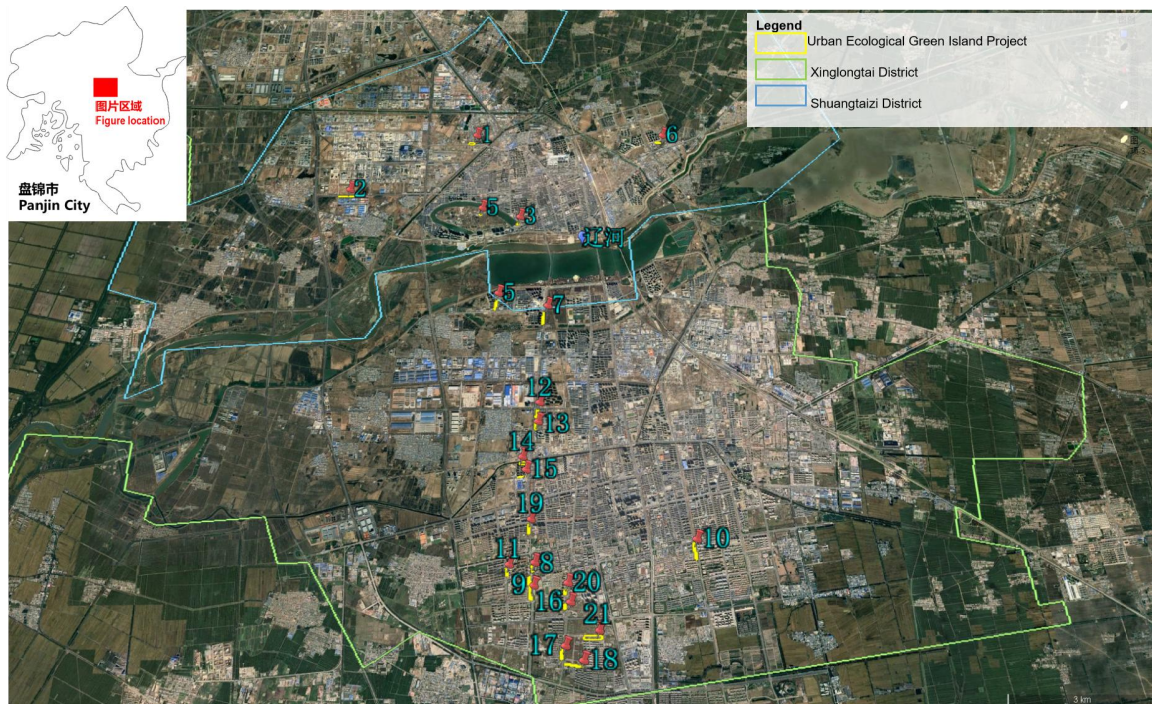
Figure 3-28 Satellite image of the Shuangqiao Street water system connection project area

Source: Project Feasibility Study Report, August 2024

124.The trapezoidal stormwater open channel is adopted. The newly built trapezoidal open channel (Hexiang Road ~ Fengshan Road) has a cross-sectional size of L=2400mm, H=3500mm, m=2, and a length of 954 meters; the trapezoidal open channel (Fengshan Road ~ Zhonghua Road) has a cross-sectional size of L=4200mm, H=3500mm, m=2, and a length of 1033 meters. The end is connected to the Xihai River, opening a new drainage channel for the southern part of the main urban area of Dawa.

3.2.4 Urban Ecological Green Spaces Construction

125.This project will carry out the construction of urban ecological green islands, that is, greening and landscaping of vacant sites such as street corners and roadsides in the urban area, and fully integrate the sponge city design concept into the project. This project includes 7 sites in Shuangtaizi District and 14 sites in Xinglongtai District, a total of 21 green spaces, and the construction of urban green islands with an area of 133,028m². The sponge-specific design of this project adopts a variety of measures such as sunken green spaces and sponge tree pools that can absorb surface runoff.



Source: ESIA Unit, November 2024

*The site numbers of the Urban Ecological Green Island Project are shown in Table 3-9.

Figure 3 -29 Urban Ecological Green Island Project Construction Location

Table 3-3 Bills of Quantities of Urban Ecological Greenway Project Quantity Table

No.	name	unit	quantity
1. Urban Ecological Green Island Construction Project (Shuangtaizi District)			
1.	1 The western section of Chengbei Street (Yipinliu)	m ²	1,497.5
2.	Highway Port Green Space	m ²	12,933.9
3.	Green space behind the public toilet on the east side of Beilin Park	m ²	3,309.9
4.	Lakeside Park East Square	m ²	7,201.6
5.	Evergrande Riverside Family East	m ²	608.5
6.	The land on the south side of the road on the south side of Huimin Community	m ²	685
7.	The Fuzi Green Space on the Left Bank of Liaohe River	m ²	5,186
(II) Urban Ecological Green Island Construction Project (Xinglongtai District)			

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8.	of Liaohe Road (Shifu Street - Huibin Sub-district) (Guangtian Thermal Power Plant)	m ²	4,193.4
9.	Liaohe Road (Huibin Sub-district -- Panyu Street) (Xinhua Jinfu Sales Office)	m ²	10,783.9
10.	Linfeng Road (Huibin Sub-district -- Yujia Street) (Blue Kangqiao Area A)	m ²	15,077.9
11.	Jincheng Road (Huibin Sub-district -- Shifu Street) (CCCC Triumph City)	m ²	465.6
12.	Liaohe Road (Park Street -- Dongyue Street) East Side (Central Hospital) North 1	m ²	493.1
13.	Liaohe Road (Park Street -- Dongyue Street) East side (Central Hospital) South 2	m ²	12,797.1
14.	Liaohe Road (Xingyou Street -- Youjin Street) on both sides (East of Jincheng Mingjun) North 1	m ²	1,958.7
15.	Liaohe Road (Xingyou Street -- Youjin Street)	m ²	3,098.2
	Both sides (East of Jincheng Mingjun) South 3		
16.	Xingyou Branch Road (Panyu Street -- Youyi Street)	m ²	2,202.2
	West side (Xinglongtai Midea City Phase III)		
17.	Xingyou Branch Road (Youyi Street -- Dazhong Street) (West of Hexiang Primary School Branch)	m ²	10,334.5
18.	Road on the north side of Xianguangfu Academy	m ²	31,438.5
19.	Liaohe Road (Shiyou Street -- Shifu Street)	m ²	5,448.8
	West side (east of National Fitness Center)		
20.	Xingyou Branch Road (Shifu Street -- Panyu Street) (Oriental Ginza)	m ²	2,006.6
21.	Youyi Street (Taishan Road -- Xingyou Branch Road) (Jiaotong District)	m ²	1,300.5
total		m ²	133,028



Source: Project Feasibility Study Report, August 2024

Figure 3-30 Ecological Green Island on the east side of Liaohe Road



Figure 3-31 Highway Port Ecological Green Island Intention (1)

Source: Project Feasibility Study Report, August 2024

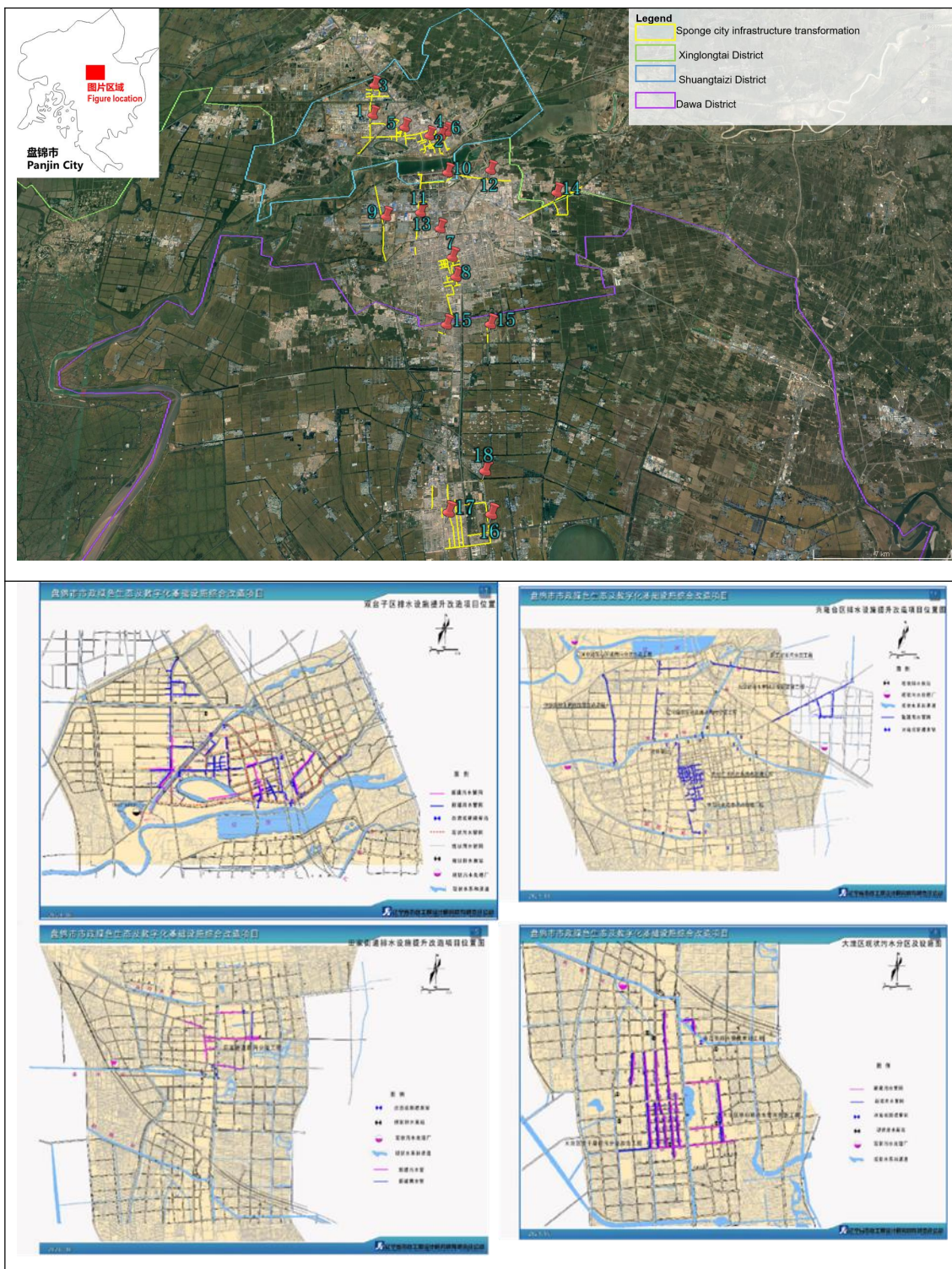


Figure 3-32 Highway Port Ecological Green Island Intention (2)

Source: Project Feasibility Study Report, August 2024

3.3Component 2: Sponge city infrastructure transformation

126.Component 2 is distributed in three areas of Panjin City: Shuangtaizi District, Xinglongtai District and Dawa District, involving six water system divisions: Yitong River, Liaohe River, Pangxieyou River, Nanhuan Water System, Qingshui River and Zhaoquan River.



Source: ESIA Unit, November 2024
 * See Table 3-10 for project numbers.

Figure 3 -33 Distribution of construction sites for drainage facility improvement projects

Table 3-10 Bill of quantities of Sponge City Infrastructure Transformation Subproject -

North of Liaohe River, Yitonghe District				
1 Jinpanhe Street Pumping Station and Upstream stormwater Pipeline Network Reconstruction Project				
No.	Project Name	unit	quantity	Note

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1	New stormwater pipes	m	4,690	Pipe diameter d600~B×H=2.0×2.0m
2	New sewage pipeline	m	2,810	
3	Renovation of gate well	pcs	5	
4	New pumping station	pcs	2	Build one new Jinpanhe Street stormwater and sewage pump station
5	Broken Road Recovery	m	4,259	2 main roads and 2 secondary roads
2 Bayi Pump Station Reconstruction and stormwater and Sewage Diversion Project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	3,615	Pipe diameter d600~B×H=2.0×2.0
2	New sewage pipeline	m	4,835	Pipe diameter d500~d800
3	Renovation of pumping stations	pcs	1	Replacement of equipment
4	Broken Road Recovery	m	9,079	5 branch roads, 1 secondary road, 2 main roads, single-side motorway
3 Taiping River Pumping Station District stormwater Pipeline Network Reconstruction Project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	1,600	Pipe diameter d600~d1200
2	Maintenance status of drainage network	m	2,610	Pipe diameter d600~d1200
3	Broken Road Recovery	m	1,600	1 sidewalk on the west side of the main road
4 Nanqian pump station renovation and stormwater and sewage diversion project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	2800	Involving 4 roads, pipe diameter d600~B×H=2.0×2.0
2	Reconstruction of pumping station	pcs	1	The original pump station will be demolished and a new stormwater and sewage pump station will be built
3	Broken Road Recovery	m	3,215	3 main roads and 1 branch road with a single motorway
5. Gujia Pumping Station Renovation and stormwater and Sewage Diversion Project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	25,590	Pipe diameter d600~d2000
2	New sewage pipeline	m	14,793	Pipe diameter d500~d800
3	Renovation of pumping stations	pcs	1	Replacement of equipment
4	Broken Road Recovery	m	8,168	Involving 12 roads (1 main road, 5 branch roads, 6 secondary roads), single-side motorway
6 Gaojia Pumping Station Reconstruction and stormwater and Sewage Diversion Project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	1,895	Pipe diameter d600~d1500
2	New sewage pipeline	m	1,960	Pipe diameter d500
3	New roads	m	760	Secondary trunk road
4	Renovation of pumping stations	pcs	1	Replacement of equipment
5	Broken Road Recovery	m	3,155	1 main road, 1 secondary road single-side motor vehicle lane
South of Liaohe River, Pangxiogou River Area				
7.Century Square Waterlogging Renovation Project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	10,997	Pipe diameter d800~d1500
2	Sunken green space	m ²	10,800	
3	Broken Road Recovery	m	12,191	3 Main road single-side motor vehicle lane and east side non-motor vehicle lane, 1 secondary road both sides non-motor vehicle lane, 8 branch roads single-side motor

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				vehicle lane
8. Renovation project of flood-prone areas around the stadium				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	6,175	Pipe diameter d800~d2200
2	Renovation of pumping stations	pcs	1	Replacement of equipment
3	Broken Road Recovery	m	7,042	1 main road and 4 secondary roads with one-side motor vehicle lanes, 1 main road with east side non-motorized vehicles, 4 branch roads with one-side motor vehicle lanes, 1 branch road with north side side pedestrian lanes
9 Zhonghua Road drainage pipeline maintenance and renovation project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	4,687	Pipe diameter d1500~d2200
2	Broken Road Recovery	m	4,687	Main Road
10 Liaohe Middle Road Pump Station Area stormwater and Sewage Diversion Reconstruction Project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	2,706	Pipe diameter d800~d1600
2	New pumping station	pcs	1	New sewage pumping station
3	Broken Road Recovery	m	2,989	1 Non-motorized lane on the east side of the main road, 1 Motorized lane on the north side of the secondary road
11 Liaohe South Road Pump Station Reconstruction and stormwater and Sewage Diversion Project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	3,415	Pipe diameter d800~d2200
2	New pumping station	pcs	1	New stormwater pumping station
3	Broken Road Recovery	m	3,452	2 non-motorized vehicle lanes on the main road, 1 main motor vehicle lane
12 Xingong Sub-district stormwater and Sewage Diversion Project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	3,911	Pipe diameter d1200~d2200
2	Broken Road Recovery	m	3,911	Main Trunk Road
13 Zhuanglin Pumping Station Design				
No.	Project Name	unit	quantity	Note
1	New pumping station	pcs	1	Demolish the original pump station and build a new stormwater and sewage pump station
14 Donghua Road stormwater pipe network and stormwater pump station construction project				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	4,517	Pipe diameter d800~d2400
2	New culvert	m	1,046	B×H=2 holes×3.5×2.0
3	New pumping station	pcs	1	New stormwater pumping station
4	Broken Road Recovery	m	4,677	2 Main Trunk Road
The area north of Qingshui River and south of South Ring Road				
15 Tianjia Sub-district stormwater and Sewage Diversion Project				
No.	Project Name	unit	quantity	Note
1	New sewage pipeline	m	553	Pipe diameter d500
2	New stormwater pipes	m	2,138	Pipe diameter d800-d1800
3	New pumping station	pcs	1	Demolish the original pump station and build a new sewage pump station
4	Broken Road Recovery	m	2,691	1 green belt on the main road, 1 sidewalk on the secondary road, 1 carriageway on the secondary road
Zhaoquanhe River Zone				
16 Dawa District Huashan Road Drainage Network Renewal Project				

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No.	Project Name	unit	quantity	Note
1	Maintenance status of drainage network	m	3,016	Pipe diameter d1200~d1800
2	Repair of sewage pipe network	m	2,010	Pipe diameter d800
3	Broken Road Recovery	m	2,009	2 Main road sidewalk
17. stormwater and sewage diversion renovation project on main roads in Dawa District				
No.	Project Name	unit	quantity	Note
1	New stormwater pipes	m	7,207	Pipe diameter d800-d2000
2	New sewage pipeline	m	11,914	Pipe diameter d400~d800
3	New pumping station	pcs	2	Build 2 new sewage pumping stations
4	Broken Road Recovery	m	16,147	5 main roads, 2 secondary roads, 2 motorway lanes of branch roads, 1 pedestrian lane of branch road and village roads
18.Chunjiang Street stormwater drainage pump station project				
No.	Project Name	unit	quantity	Note
1	New open channel	m	60	B*H=2000*2400
2	New pumping station	pcs	1	1 new stormwater pumping station
Pump station equipment renewal project				
19. Shuangtaizi drainage pump station equipment update				
No.	Project Name	unit	quantity	Note
1	New sewage pipeline	m	340	
2	New pumping station	pcs	1	1 new sewage pumping station was built
3	Pump station equipment update	pcs	7	Replacement of equipment
20. Xinglongtai District Drainage Pump Station Equipment Update				
No.	Project Name	unit	quantity	Note
1	New sewage pipeline	m	200	Pipe diameter DN1500
2	Pump station equipment update	pcs	30	Replacement of equipment
21. Dawa District Drainage Pump Station Equipment Update				
No.	Project Name	unit	quantity	Note
1	Pump station equipment update	pcs	4	Replacement of equipment
2	Reservoir	pcs	4	3 5000m ³ regulating and storage tanks, 1 3000m ³ regulating and storage tank
other				
Purchase of operation and maintenance support equipment				
	Equipment Type	unit	quantity	
	Sewage suction truck (combined flushing and suction)	Vehicle	4	
	Sewage suction truck (single flush)	Vehicle	8	
	Urban flood drainage rescue vehicle	Vehicle	4	
	Pickup Truck	Vehicle	12	
	Operation support vehicle	Vehicle	4	

High power water pump	pcs	40
High power generator	pcs	10
Toxic gas detector	pcs	3
Emergency lighting equipment	set	10
Satellite Phone	pcs	10
CCTV Pipeline Inspection Robot	pcs	6

3.4 Component 3: Digitalization of urban drainage management system

127. The Digitalization of urban drainage management system sub-project includes the following two aspects: (i) Conducting a detailed survey of Panjin's underground pipe network based on the original survey results; (ii) Building a digital platform for drainage pipe network infrastructure. This project uses modern information technology to achieve a multi-dimensional information management platform that "manages multiple waters, treats multiple pollutants, and coordinates and controls them". It uses GIS technology, Internet technology, Internet of Things and other technologies to achieve drainage facility asset management, dynamic monitoring and early warning of drainage facility operation, grid inspection and maintenance of drainage facilities, three-dimensional visualization of drainage facilities, drainage household information management, joint scheduling of drainage facilities, and background data maintenance. It also realizes the information sharing and utilization of drainage facility approval management by various commissions, offices and bureaus in the city. The implementation of the project provides decision-making support for the "plant-network-river-lake" scheduling and improves the level of smart urban management in Panjin.

3.5 Component 4: Capacity Building

128. The capacity building sub-project will recruit consulting firms with experience in project management of international financial organizations, organize training and learning for project management and implementation-related personnel, organize project management personnel to conduct on-site inspections, conduct public participation surveys, public publicity services, project management software (MIS system) procurement, office printing and express delivery, and other related contents.

(i). Staff training

129. The subproject plans to provide technical training and low-carbon training to management personnel and technical personnel, and provide procurement training and green construction training to project implementation and operation and maintenance personnel, so that all types of personnel have the ability to manage, operate and build drainage systems.

(ii). Domestic study tour

130. In order to gain an in-depth understanding of successful cases, technology applications and project management practices in green infrastructure construction and digital platform construction, typical domestic cities are selected as inspection objects, and training is conducted once a year during the project construction period. Field study tour are conducted on green ecological facilities such as parks and green spaces, ecological restoration projects, and green buildings in the target cities to understand the technical means, materials and equipment used in green ecological facilities, as well as their actual effects in energy conservation, emission reduction, and ecological restoration. In addition, it will communicate with facility management units to understand their experience and problems in operation and maintenance methods, and refer to the digital operation and management center of the target city to understand the integration, display and application of digital infrastructure.

3.6 Summary of Project Construction Activity Categories

131. According to Sections 3.2-3.5, the project includes 4 sub-projects and 41 sub-projects in total. Each sub-project consists of different types of project activities, such as the "Youyi Street Water System Connection Project" in the "Component 1 - Wetland Restoration and Conservation", which includes stormwater pipelines, landscapes, park trails, revetments, open channels and other types of construction activities. Due to the large differences in the environmental and social impacts of various construction activities, if the environmental and social impacts are evaluated separately according to the 41 sub-projects, the evaluation content will be repeated and lengthy, and it is adverse to targeted identification of protection targets and the proposal of reliable and effective mitigation measures.

132. In order to more accurately identify and assess the environmental and social impacts of project construction and operation, this section will conduct an engineering analysis of the project and classify project activities according to the content of the project construction, providing a basis for assessing the main impact of the project construction and operation stages in Chapters 5 and 6.

133. According to the construction content, the physical works of this project can be divided into the following categories: (1) Wetland landscape ; (2) Park; (3) Shoreline slope protection; (4) Pipeline; (5) Road; (6) Pump station; (7) Channel; (8) Bridge. The main construction contents of this activity are shown in Table 3-11.

Table 3-11 Project activity classification and construction content brief introduction

No.	Project activity classification	Main Activities
(1)	Wetland restoration	Land preparation; dredging; vegetation planting;
(2)	garden	Build squares; park trails; plant vegetation;
(3)	Shoreline protection	Ecological chain lock block slope protection; vegetation planting;
(4)	pipeline	Construction of new stormwater and sewage pipes;
(5)	Road	New road construction; road surface breaching and restoration;
(6)	Pumping Station	New construction, demolition and reconstruction, and expansion of pump stations; replacement of pump station equipment;
(7)	channel	New construction and reconstruction of rainwater open channels and underground channels
(8)	bridge	Build a new bridge.

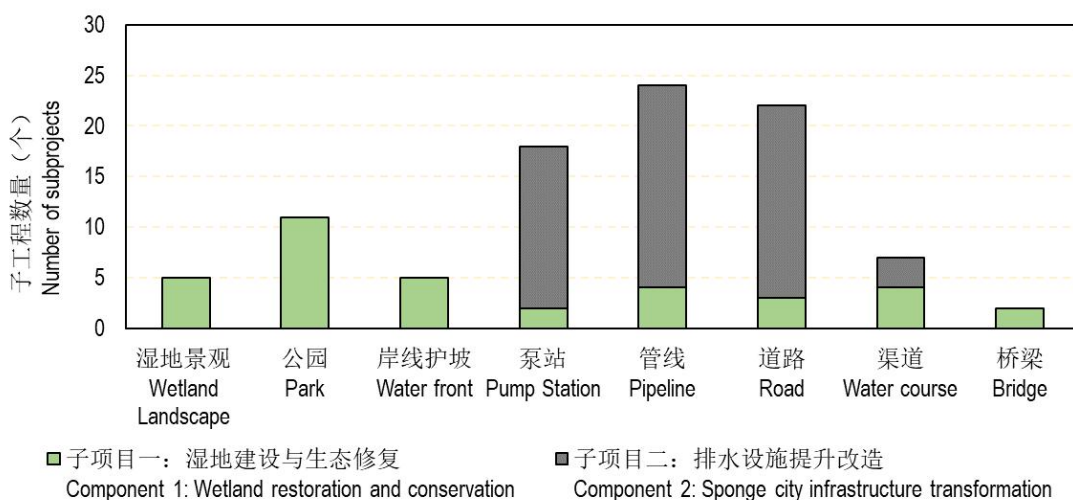


Figure 3 -34 Bar chart of Classification of subprojects

Table 3 - 12 Project activity classification and construction content

No.	Project List			Project Activities																
				(1) Wetland Landscape			(2) Parks	(3) Shoreline slope protection	(4) Pipeline (m)		(5) Channel (m)		(6) Road (m)		(7) Pumping station			(8) Bridges		
				Ecological dredging (m ³)	Land preparation (m ³)		Vegetation (stock)	Area (m ²)	Length (m)	Sewage	rainwater	Culvert	Open Channel	New roads	Broken Road Recovery	New	reconstruction	Renovation	seat	Length (m)
Cut	Fill																			
1	Component 1	Water system connectivity	Yangjia Canal Wetland Park Construction Project	12000	28800	35200	8700	95000												
2			Yijiang Road Water System Connection Project								100	400			100		1			
3			Zhonghua Road Drainage Channel Project									900	2500		900				7	30
4			Youyi Street water system connected	10764	29862		1320	112500				2412		3804						
5			Shihua Road South Section (Youyi Street - Huancheng South Street) Rainwater Pumping Station and Supporting Project								1420	2630	80		1481		1			1
6		Ecological wetland restoration	Liaohu Sluice Park Ecological Restoration and Improvement Project				3500	115000												
7			Liaohu Forest of Steles Park Wetland Ecological Restoration and Improvement Project	9500	6200	7800	450	9100	550											
8			Tianjia Ecological Corridor Project	117750	7500	5200	8300	173500	7600											
9			Hundred-acre lotus pond ecological restoration project		46000	25000	2750	1200000	1200											
10		Ecological revetment	Yitong River Ecological Restoration and Improvement Project				4294	26300	1600											
11			Greening project on both sides of Goupan Canal				4300	48400	2200											
12			Urban North Row Slope Protection Project						2100											
13			Nanhuan water system, Crab Ditch, Shangfang dry shoreline improvement project					26000												
14			Shuangqiao Street Water System Connection Project										1987							
15			Urban Green Island	Urban Ecological Green Island Construction Project (Shuangtaizi District)					31429											
16			Urban Ecological					101599												

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			Green Island Construction Project (Xinglongtai District)																			
17	Component 2	North of Liaohe River, Yitonghe District	Jinpanhe Street Pumping Station and Upstream Rainwater Pipeline Network Reconstruction Project						2810	4140	550			4259	1							
18			Bayi Pumping Station Renovation and Rainwater and Sewage Diversion Project						4450	3035	580			9079				1				
19			Taiping River Pumping Station District Rainwater Pipeline Network Reconstruction Project								1600				1600							
20			Southward pump station renovation and rainwater and sewage diversion project								2350	450			3215		1					
21			Gujia Pumping Station Renovation and Rainwater and Sewage Diversion Project							14790	27190				8168				1			
22			Gaojia Pumping Station Renovation and Rainwater and Sewage Diversion Project							1960	1850		760		3115				1			
23			Shuangtaizi drainage pump station equipment update							340						1			7			
24			Renovation project of flood-prone areas near Century Square								10997				12191							
25		Renovation project of flood-prone areas around the stadium								5360				7042				1				
26		Zhonghua Road drainage pipeline maintenance and renovation project								4687				4687								
27		Liaohe Middle Road Pump Station Area Rainwater and Sewage Diversion Reconstruction Project								2706				2989	1			1				
28		Liaohe South Road Pump Station Renovation and Rainwater and Sewage Diversion Project								3365				3452	1							
29		Xingong Sub-district Rainwater and Sewage Diversion Project								3911				3911								
30	Zhuanglin Pumping																1					

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			Station																	
31			Donghua Road rainwater pipe network and rainwater pump station construction project							4671	1046			4677	1					
32			Xinglongtai District Drainage Pump Station Equipment Update						200								30			
33		Tianjia Sub-district	Tianjia Sub-district Rainwater and Sewage Diversion Project						553	2138				2691		1				
34		Zhaoquanhe Sub-district	Dawa District Huashan Road Drainage Network Renewal Project						2010	3016				2009						
35	Dawa District Trunk Road Rainwater and Sewage Diversion Reconstruction Project								11483	7207				16147	2					
36	Chunjiang Street rainwater drainage pump station project											60				1				
37	Dawa District Drainage Pump Station Equipment Update									1200								4		
38		other	Panjin City Main Urban Area Underground Drainage Pipeline Network Physical Examination Project																	
39			Operation and maintenance equipment																	
40	Component 3		Digital infrastructure platform and capacity building																	
41	Component 4		Capacity Building																	
Total				150014	118362	73200	33614	1938828	15250	41216	93365	4006	8351	2241	90232	9	4	46	8	82

3.7 Associated Facility Analysis

134. According to the AIB "Environmental and Social Framework" (2024 revision), the definition of "facilities" on associated facilities refers to the project activities not included in the project legal agreement, but these activities are inherently related to the project construction content. The main definition principles are: (a) directly and substantially related to the project; (b) carried out, or planned to be carried out, contemporaneously with the Project; and (c) necessary for the Project to be viable and would not be carried out if the Project did not exist.

135. The facilities related to the operation of this project include water supply plants and sewage treatment plants related to the water supply, reclaimed water, and sewage pipe network engineering of the project construction. According to the above definition principles, the associated facilities of this project are determined through the associated facility judgment matrix (Table 3-13) as follows:

Table 3-13 Project-related facility identification matrix

Facility Name	Directly and Materially Related to the Project	Contemporaneously with or Planned for the Project	Necessary for the Project to be Viable	Note
The First Wastewater Treatment Plant	Yes	No	Yes	The First WWTP is responsible for wastewater treatment in the central sewage catchment area of Xinglongtai, with an operating scale of 95,000 to 120,000 m ³ /d and is identified as an existing facility.
The Second Wastewater Treatment Plant	Yes	No	Yes	The Second WWTP is responsible for wastewater treatment in the sewage catchment area on both sides of the Liaohe River, with an operating scale of nearly 60,000 m ³ /d and is identified as an existing facility.
The Third Wastewater Treatment Plant	Yes	No	Yes	The Third WWTP is responsible for wastewater treatment in the eastern sewage catchment area of Xinglongtai, with an operating scale of 46,000-47,000 m ³ /d and is identified as an existing facility.
The Tianjia Wastewater Treatment Plant	Yes	No	Yes	The Tianjia WWTP is responsible for wastewater treatment in the sewage catchment area of Tianjia, with an operating scale of 25,000 m ³ /d and is identified as an existing facility.
The Dawa Wastewater Treatment Plant	Yes	No	Yes	The Dawa WWTP is responsible for wastewater treatment in the sewage catchment area of Dawa, with an operating scale of 40,000 m ³ /d and is identified as an existing facility.

136. The First Wastewater Treatment Plant, the Second Wastewater Treatment Plant, the Third Wastewater Treatment Plant, the Tianjia Wastewater Treatment Plant, and the Dawa Wastewater Treatment Plant, will receive and treat the sewage collected by the sewage pipe network to be built for the project. Without the above sewage treatment plants, the sewage cannot be effectively treated; since the above sewage treatment plants are all completed sewage treatment plants, they do not meet the second criterion of associated facilities, "constructed at the same time as the project or planned", so the above sewage treatment plants cannot be identified as associated facilities of this project and are identified as existing facilities. Therefore, this project has no associated facilities.

4 Alternatives

137. Alternative is an important part of environmental and social impact assessment. This section examines the feasibility of alternatives from an environmental and social perspective, assesses potential adverse environmental and social impacts, and examines the impact of site selection on land acquisition and resettlement in order to avoid or minimize involuntary resettlement and its impact on ethnic minorities. The alternatives of the proposed project are compared, including the comparison with and without the project and the comparison of technical solutions.

4.1 With/Without project alternative

138. Without project replacement means that the project will not be constructed. If the status quo is maintained, the factors that lead to frequent waterlogging and wetland degradation in Panjin City will still exist. If this project is not built, Panjin City will still face the following problems:

1. **Wetland degradation and poor water connectivity.** Urban development and expansion, oil field development and other industrial construction have changed the characteristics of the original natural wetlands. Urban wetlands have formed unevenly distributed, small, isolated wetland patches, and their ecological functions have been disturbed and affected by human activities. Agricultural development has caused the canals connecting local paddy fields and wetlands to be destroyed and silted up, resulting in a decline in the function of canal water system connectivity.
2. Frequently urban waterlogging, and insufficient climate change resilience. The underground drainage network in Panjin City was built early, and most of them are combined sewer systems with small pipe diameters, which are seriously blocked with seriously insufficient drainage capacity. The original drainage pump station equipment is old, damaged, and energy-intensive, and poor drainage capacity. The existing drainage channels have uneven flood discharge capacity, which affects the efficiency of urban flood discharge, resulting in waterlogging in urban areas during the rainy season. The drainage capacity of the existing combined sewer system can no longer cope with the rainfall caused by climate change. In addition, the existing green spaces in Panjin City do not have a sponge function and waterlogging on the ground is very fast during rainfall, resulting in insufficient capability to address extreme rainfall events caused by climate change.
3. Serious combined sewer overflow pollution. The drainage system in most areas of Panjin's main urban area is an interception-type combined sewer system, which causes sewage overflow during the rainy season. The overflow sewage directly flows into existing rivers and wetlands, causing serious water pollution and threatening the health of the water ecology.
4. Backward drainage system management methods and inexperienced managers. The existing drainage system in Panjin City has problems such as incomplete census data, backward management methods, inexperienced managers, and inadequate post-maintenance, which have led to damage and siltation of drainage pipes, affecting pipeline drainage.
5. Urban waterlogging causes significant economic losses and threatens the safety of people's lives and property. If the status quo is maintained, urban waterlogging in Panjin caused by extreme precipitation events cannot be improved. Urban waterlogging affects the travel safety of Panjin residents, even causes people to be trapped, infrastructure to be damaged, and houses to collapse, which will cause significant direct or indirect economic losses and threaten

the safety of people's lives and property in Panjin.

139. With project, that is, the existing project plan, which transforms Panjin's existing gray stormwater infrastructure and incorporates low-impact development measures, and adopts green infrastructure as much as possible where appropriate. The gray stormwater infrastructure to be built and renovated in Panjin includes stormwater and sewage separation in the urban drainage network, and the transformation of drainage channels and drainage pumping stations. The construction of green infrastructure in Panjin includes low-impact development facilities at the source and urban blocks, and the restoration of urban riverside wetland parks and waterfront ecological shorelines. If this project plan is implemented, the integration of green infrastructure measures into the existing gray stormwater infrastructure will produce positive environmental and social benefits:

140. **Environmental benefits:** In the short term, the implementation of the project can address extreme weather caused by climate change, and improve the overall environmental quality of the city in the long term. The area of urban green space will be increased, the emission reduction capacity at the source will be improved, and the functions of green infrastructure such as natural purification, ecological protection, flood storage, prevention of downstream flooding, and protection of natural resources will be brought into play. Wetlands, forests and green spaces in cities can not only mitigate floods, droughts and heat island effects, but also reduce greenhouse gas emissions through carbon sink functions. In addition, the restored riverside wetlands provide habitats for various animals and plants, especially for wetland waterfowl to increase foraging and resting places, protecting the biodiversity of Panjin City. By transforming the drainage system to separate stormwater and sewage, the sewage overflowing to the downstream natural water bodies can be reduced, and the water environment quality of the downstream Liaohe estuary and Liaohekou wetlands can be improved.

141. **Social benefits:** The implementation of the project can help cities adapt to climate change, reduce urban waterlogging, decline direct or indirect economic losses caused by waterlogging, and reduce urban maintenance expenses. Also, it can reduce the risk of flood disasters faced by urban residents, protect their lives and improve their quality of life. The increased urban green space and restored riverside wetlands will provide more recreational space for urban residents, making the city more livable and comprehensively improving the social and economic benefits of the city.

142. In addition to the positive environmental and social benefits, if the project plan is implemented, it will cause certain negative impacts that can be mitigated: such as noise, dust, disturbance of the main canal habitat caused by dredging, and traffic interruption during construction, which will disappear after the construction is completed. Such negative impacts are short-term. The With project plan also involves land acquisition, involuntary resettlement, livelihood restoration and other issues. The land to be acquired for the new Shihua Road in this project is a state-owned farm. If the project plan is implemented, the livelihoods of the employees of the state-owned farm to be acquired will be affected, including but not limited to unemployment, reduced income, and reduced living standards. This project will implement a resettlement action plan with the goal of restoring the living standards and economic income of the project-affected people to improving and increasing them as much as possible, and reducing the adverse effects caused by land acquisition.

143. In summary, the no-project solution cannot achieve the goals of the project in wetland ecological restoration, climate change response, urban waterlogging, water environment and ecology improvement, and drainage system management capacity improvement, and can not achieve a smart management, low-impact development climate resilience demonstration city. Compared with the no-project solution, the project solution with slight reversible impacts and positive environmental and social benefits is more acceptable. Therefore, the no-project solution is not considered.

4.2 Comparison and Selection of Technical Alternatives

4.2.1 Comparison and Selection of Water System Connection Routes

144. In order to achieve effective connection between water systems and decline the existing water drainage pressure, this project selects different technical solutions to effectively reduce the occurrence of flood disasters and achieve flood diversion and relief by guiding water flow and regulating water levels. The construction of channels, bridges and other infrastructure connecting water areas will help restore

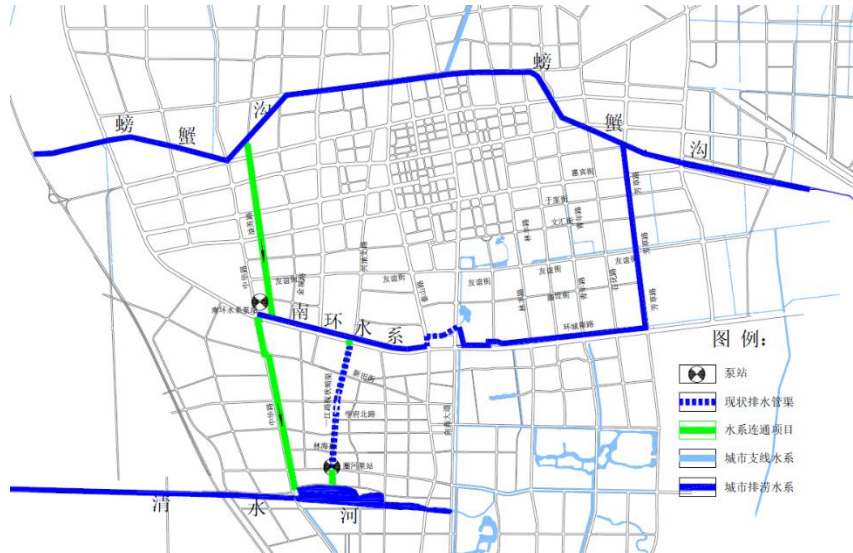
the water ecosystem, achieve the exchange and migration of various biological resources, and maintain local ecological balance.

145.Option 1: The Option 1 mainly uses Youying Road-Zhonghua Road/Yijiang Road to add drainage channels. After the implementation of the plan, the water system connection route is: the downstream of Pangxieyou River passes through the Youying Road drainage channel, Zhonghua Road and Yijiang Road drainage channels, and flows to Qingshui River. The engineerings of Option 1 are mainly in the western part of Panjin City, adding drainage channels to the Pangxieyou basin, and regulating the basin flow at the downstream of Pangxieyou River, fewer canals are involved in the construction with less engineerings and lower investment. However, the site selection of Youying Road is not feasible because the elevation of the starting and ending points does not match, and the underground pipelines are complicated, intersecting with the existing oil pipelines, and many inverted siphons. The current site selection of Youying Road in Option 1 is green space. If Option 1 is implemented, the current park green space will be destroyed and 24 mu of state-owned green space will be permanently occupied; in addition, according to field investigations, the site selection of Youying Road is within 5 meters of the high-voltage power line channel. According to the "Regulations on the Protection of Power Facilities", within the protection range of the high-voltage power line channel, operations that may endanger the safety of power facilities, such as building houses, digging ditches, and planting trees, are prohibited. The site selection for Youying Road conflicts with the protection range of high-voltage power lines, therefore, the Option 1 cannot be implemented.



Source: ESIA Unit, November 2024

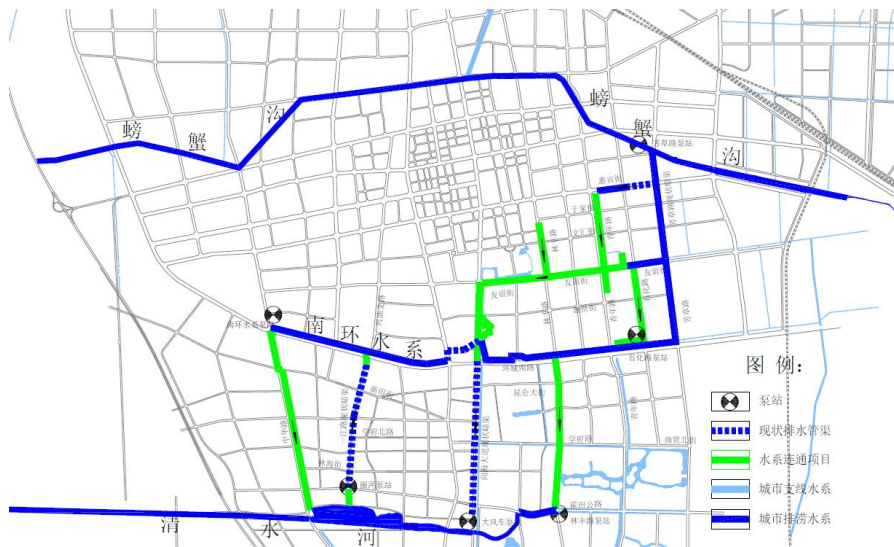
Figure 4 - 1 Photo of High-voltage power line channel at the project site of the drainage channel on Youying Road



Source: Project Feasibility Study Report, August 2024

Figure 4-2 Connectivity diagram of urban drainage system - Option 1

146.Option 2: The Option 2 mainly uses Youyi Street-Yangjia Canal-Zhonghua Road/Yijiang Road-Shihua Road to add drainage channels, which is a gray-green combination plan. In terms of the gray system, necessary engineering facilities such as pumping stations and pipelines are built to ensure the collection and transportation of water resources and the elimination of urban waterlogging ; in terms of the green system, through measures such as widening or repairing the original river channel and building culverts, effective connectivity of natural water bodies such as rivers, lakes and wetlands is achieved; natural elements such as wetlands and aquatic plants are used to build a green purification system to enhance the self-purification capacity of water bodies and the ecological landscape effect. The urban water system constructed by the gray-green combination of Option 2 not only has the function of sewage collection and treatment, but also helps to achieve the carbon neutrality goal of the sewage treatment industry. It also has a variety of service functions such as ecological landscape, leisure and entertainment. Green systems (such as wetlands, rivers, etc.) can not only form carbon sinks, but also provide cities with a beautiful ecological environment and leisure space, improving the quality of life of urban residents. Compared with Option 1, Option 2 has a large amount of engineering, and the construction involves more urban drainage water systems, and the investment cost is higher.



Source: Project Feasibility Study Report, August 2024

Figure 4-1 Connectivity diagram of urban drainage system - Option 2

Table 4 - 1 Summary of comparison of water system connection route options

Chapter 4 Alternatives

Option	Advantages	Shortcomings
Option 1: Add drainage channels between Youying Road, Zhonghua Road and Yijiang Road	Relatively less engineering, less roads and canals involved in the construction, relatively lower environmental disturbance, and relatively low investment.	The underground pipelines are complex and intertwined with oil pipelines; Permanent occupation of 24 mu of state-owned green space; Conflicts with the protection range of high-voltage power lines.
Option 2: Add drainage channels from Youyi Street to Yangjia Canal to Zhonghua Road / Yijiang Road to Shihua Road	The combination of gray and green can eliminate waterlogging, improve the self-purification capacity of water bodies and the ecological landscape.	The project volume is large, the construction involves many urban drainage water systems, and the investment is high

147. Overall, Option 2 is the best option for this project. Overall, to avoid permanent occupation of state-owned land, avoid demolition and expropriation, avoid damage to high-voltage power facilities during project construction, and for the safety of construction workers, Option 2 is considered for this project. The implementation of Option 2 can reduce the permanent occupation of state-owned green land by 24 mu.

4.2.2 Site Alternatives Selection

148. Multiple options were compared for the site selection of the Yijiang Road water system connection project and Gaojia Pump Station Renovation and Rainwater and Sewage Diversion Project involved in Component 1, Donghua Road rainwater pump station construction project involved in Component 2. On the premise of meeting the layout and technical standards for the drainage facility renovation and improvement, the construction site was changed to avoid the occupation of collective land and state-owned land for new permanent land and to avoid expropriation and demolition.

Table 4 - 2 Summary of site alternatives selection

Project name	Option 1	Option 2	Preferred option	Avoided resettlement impact
Yijiang Road water system connection project	It is mainly located in western Panjin City, and intersected with existing petroleum pipelines, and has multiple inverted rainbows, damaging existing parks and green spaces, and conflicting with the protection range of the high-voltage power line.	Add flood drainage channels along Youyi Street-Yangjia Canal-Zhonghua Road / Yijiang Road-Shihua Road, and adopt a gray-green combination scheme.	Option 2	Avoid the permanent occupation of 24 mu of state-owned green space.
Gaojia Pump Station renovation and rainwater and sewage	Constructing a 760m long, 15m wide new straight road between Dongfeng Street and Weiba Street,	Constructing the new road along the existing curved railway	Option 2	Avoid the expropriation of houses of 3,689 m ² , affecting 19 less households.

diversion project	with a sidewalk width of 10m			
Donghua Road rainwater pipe network and rainwater pump station construction project	Constructing on the right side, involving the acquisition of 7 mu of collective land, affecting 3 households with 11 people	Reconstructing on the existing road, occupying about 35.03 mu of land temporarily, not involving additional permanent LA	Option 2	Avoid the acquisition of 7 mu of collective land, affecting 3 less households with 11 people.

149. Overall, to avoid addition of permanent occupation of collective land and state-owned land, and to avoid expropriation, as well as to avoid the resettlement impact as possible, the Project prefers to Option 2 with less impact of land occupation.

4.2.3 Comparison and Selection of Pipeline construction technology

150. There are two common construction methods for laying drainage pipes: pipe jacking and trenching.

(i) Pipe jacking method

151. The pipe jacking construction method is a pipeline burial construction technology that does not involve excavation or less excavation. In the working pit, the friction between the pipeline and the surrounding soil is overcome by the jacking force generated by the jacking equipment, and the pipe is pushed into the designated position according to the designed slope, and the soil in the pipeline is transported out. When one section of the pipe is pushed into the soil layer, the second section of the pipe is pushed in, and so on to complete the remaining pipeline construction work. Pipe jacking construction does not affect the traffic and the normal use function of the building; it can shorten the pipeline laying cycle, reduce the project cost relatively, have little impact on the original road soil layer, and avoid the reset of greening projects on the pipeline. The equipment used is single and easy to operate. While reducing the amount of earth excavation, it also reduces the amount of earth abandonment and backfilling machinery, protecting the surrounding environment. It is suitable for the construction of built-up buildings, railways, highways and underground pipeline projects in narrow sections with large traffic volume, where it is difficult or inappropriate to dig trenches.

(ii) Trenching construction method

152. The trenching method is also called the open excavation method. The general process is to start trenching after the alignment measurement is completed, and make support. For areas with shallow groundwater levels and greater impact from groundwater during trenching, construction precipitation treatment is required. The construction method is simple, the construction technology is relatively easy, and the applicable pipe diameter range is relatively large. However, in urban drainage construction, due to the influence of traffic environmental protection and ground structures, it is not suitable for large-scale excavation. The pipeline laying period is long, the project cost is relatively high, and the original road soil layer and structure are changed.

Table 4 -3 Summary of comparison of drainage pipeline construction methods

Construction method	Environmental impact	Social Impact	advantage	shortcoming
Pipe jacking method	-Smaller environmental impact; -No road digging, no traffic closure,	-Smaller social impact; -Ground activities are basically unaffected by	-The construction occupies a small area, has low noise and no dust ;	-The technology is difficult; -Factors such as soil quality and groundwater

	no pipeline relocation; -Able to safely cross complex terrains such as railways, roads, rivers, etc.	construction, and there is little disruption to traffic ; -Little impact on the living environment of residents and does not affect the use of existing pipelines and structures.	-It has little disturbance to the surrounding soil and can effectively control the settlement of the ground and pipelines;	level may affect the construction progress and quality; -Relatively high cost: high construction cost
Trenching construction method	-Certain ; -Large-scale excavation of the ground, destroying green areas, vegetation and road integrity ; -Generates pollutants such as noise, dust and vibration	-Certain; -Occupies road space leading to traffic jam and traffic accident risks	-The technology is mature; -The cost is lower.	-Produce noise and disturbance to the surrounding environment, affecting the normal life of residents ; -Causes great disruption to urban traffic

153. Considering the construction progress and cost, most of the works in this project adopt the trenching construction method. According to the soil conditions along each pipe section and the laying depth of the pipeline, straight or stepped trenching is used as appropriate. During construction, in order to reduce the impact on existing obstacles and the risk of construction, protective measures such as steel sheet piles are required during excavation. In the Taishan Road (Shifu Street ~ Zhuanglin Pump Station) section of Century Square Waterlogging Renovation Project, a new 1984m DN 1500 stormwater pipeline will be built, of which 200m will be constructed by the pipe jacking construction method. The road section is narrow and densely populated. In order to minimize the impact on residents' travel, the pipe jacking construction method is selected.

4.2.4 Cross-sectional design

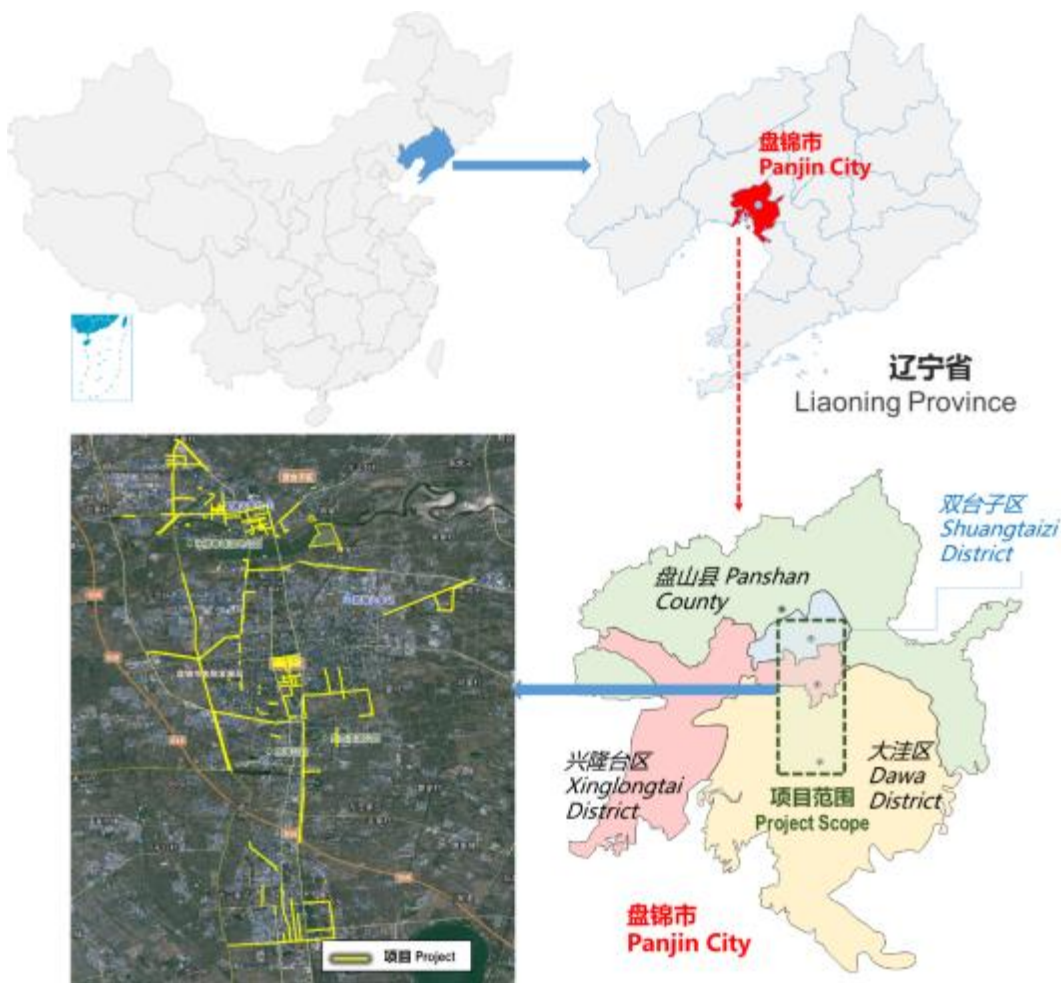
154. Changing the traditional mode of drainage solely by municipal pipelines, on the basis of meeting basic functions such as road traffic safety, urban roads and surrounding green spaces will be used fully to implement low-impact development facilities. Combined with road cross-sections and drainage directions green belts, carriageways, sidewalks and parking lots of roads of different grades will be used to build sunken green spaces, grass-planted ditches, rainwater wetlands, permeable pavements, infiltration pipes/channels and other low-impact development facilities. Through infiltration, storage and purification, the control goals of road low-impact development will be achieved.

5 Description of the Environmental and Social Economic Development

5.1 Natural Environment

5.1.1 Location

201. Panjin City is located in the southwest of Liaoning Province and the center of the Liaohe River Delta. Its geographical coordinates are between 121°25' and 122°31' east longitude and 40°39' and 41°27' north latitude. It is adjacent to Anshan City in the northeast, Yingkou City across the Liaohe River in the southeast, Jinzhou City in the northwest, and Liaodong Bay of the Bohai Sea in the south. It has a geographical environment of being close to the river and the sea.



Source: ESIA Consultant Nov 2024

Figure 5-1 Project area location diagram

202. The central urban area of Panjin consists of Xinglongtai, Shuangtaizi and Tianjia area of Dawa District. It is bounded by Taiping River in the north, development boundary in the east, Danxi Expressway in the south and Xihuan Road in the west. It has a total area of about 175.9 km² and the current built-up area is 107km².

5.1.2 Meteorology

203. Panjin City belongs to the warm temperate continental semi-humid monsoon climate zone, which is characterized by four distinct seasons, rainy and hot seasons, dry and cold seasons, suitable temperatures and abundant sunlight.

204. In 2022, the annual average temperature in Panjin is 10.3°C, the highest temperature is 33.9 °C and the lowest temperature is -17.4°C. The annual precipitation is 895.7mm, 244.7mm more than the 651.0mm in previous years. The month with the most precipitation is July, with a precipitation of 311mm. The sunshine hours are 2421 hours, 304.9 hours less than the 2725.9 hours in previous years. The annual average wind speed is 2.8m/s, and there are 17 days of strong winds ((Beaufort Wind Force Scale)) in the whole year. The soil begins to freeze in mid-November. The thawing period is in early March and early April. There are 119 rainy days, 22 snowy days, and 10 foggy days in the whole year.

205. Due to its special geographical location, close to mountains and the sea, and the influence of the natural environment and atmospheric circulation, Panjin City's main weather and climate events include rainstorms, hail, cold waves, strong winds, heavy fog, etc. These disasters are characterized by strong suddenness, high intensity and short duration.

5.1.3 Geology, topography, landforms

206. Panjin City is located in the southwest of Liaoning Province, in the Liaohe River Delta, in the Cenozoic sedimentary basin formed in the northeast of the North China Plateau from the "Yanshan Movement". The average altitude of Panjin is about 4 meters, with a maximum of 18.2 meters and a minimum of 0.3 meters. The main landform is an alluvial plain. The topography and geomorphology are high in the north and low in the south, gradually sloping from north to south, with a gradient of one ten-thousandth and a slope of less than 2°; the eastern part of the plain, starting from the right bank of the Liaohe River and the Daliaohe River, gradually slopes from northeast to southwest, with an altitude of 3 to 10 meters; the middle part of the plain is low-lying and flat, with an altitude of between 2.5 and 4 meters; the southwest coastal area of the plain is a swamp area, with an altitude of between 1.7 and 3 meters.

207. Panjin is located in the Liaohe River Delta, and its natural landform is basin-shaped. The Hunhe River and Taizi River in the east merge to form the Daliao River, which flows into the sea through Liaobin and Yingkou, and flows into the alluvial plain in the south of the Daliao River; the Liaohe River (Shuangtaizi River) in the middle passes through Xixia of Panshan Mountain and merges with the Raoyang River to flow into the sea. The upper reaches of the basin are mostly mountainous and hilly. In the lower reaches of the Liaohe River, the river channel ratio of the plain suddenly decreases, forming a continuous swamp in the estuary of the Shuangtaizi River, forming an alluvial plain. The terrain is flat and open, and the rivers and channels are crisscrossed. The upper reaches of the Raoyang River and the Daling River in the west are mountainous and hilly areas, so that the basin is scattered with low sand dunes, sandy land and sandy carbonate meadow soil in the northwest edge⁸.

208. From the perspective of geological conditions, Panjin City is mainly composed of Quaternary and Tertiary strata. The Tertiary strata are rich in oil and natural gas resources, and the thickness of the Quaternary strata is 250 to 350 mm. The surface is covered by Quaternary sediments, which are sub-clay layer, sub-sand layer, silt layer and silty sub-clay layer from top to bottom. The main mineral resources are oil, natural gas, well salt, etc.

⁸ [Panjin terrain and mountains - Baidu Library \(baidu.com\)](#)

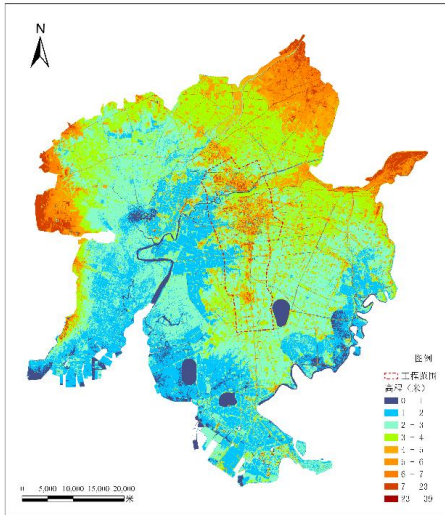


Figure 5-2 Panjin City's whole area elevation analysis

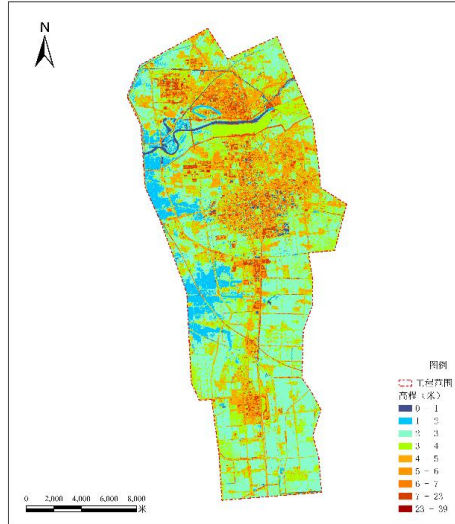


Figure 5-3 scope elevation analysis

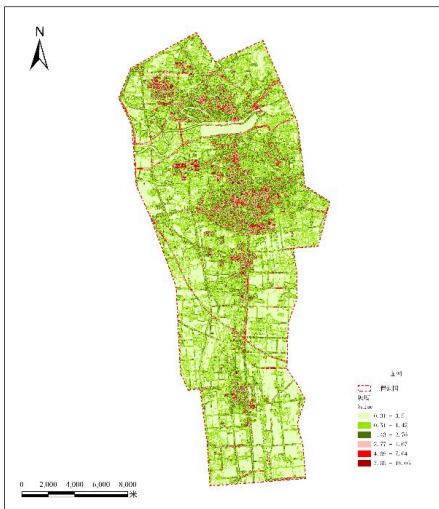


Figure 5-4 Slope analysis diagram of project scope

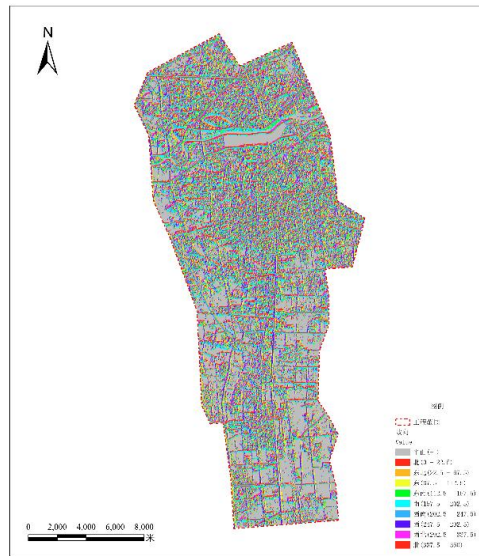
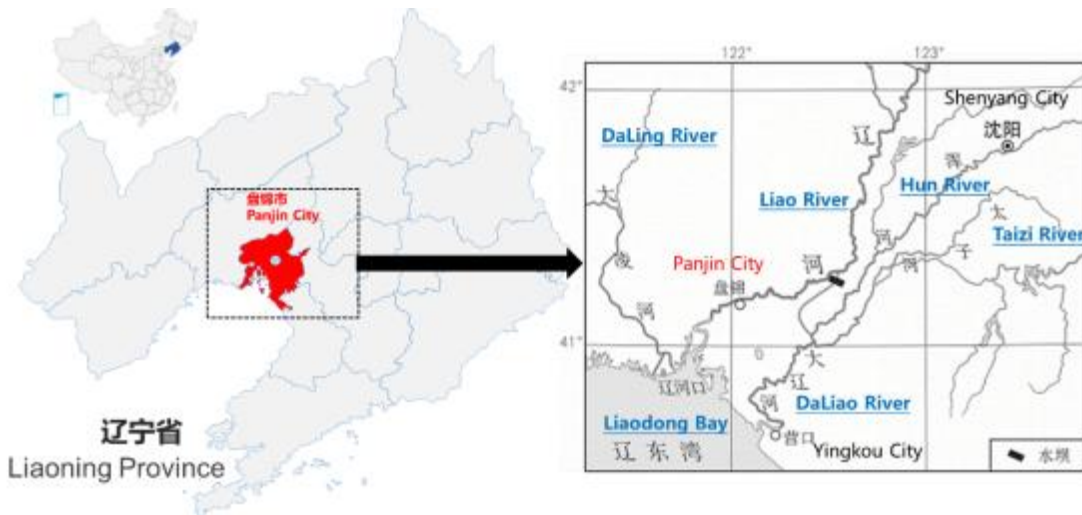


Figure 5-5 Slope analysis diagram of project scope

Source: Project FSR, August 2024

5.1.4 Hydrology and water system

209. Panjin City belongs to the Liaohe River Basin, which is 116 km long (from Liujianfang to the estuary) in Panjin City, with a drainage area of 2438.38 km². The regional surface water system mainly includes rivers such as the Liao River, Daliao River, Raoyang River, and Daling River that flow into the sea from Panjin. Among them, the Liao River and Daling River in the region are the dominant factors in forming and maintaining the wetland ecosystem of Panjin City. The surrounding water system of Panjin City is shown in the following figure.



Source: ESIA Consultant Nov 2024

Figure 5-6 Water system map around Panjin

210. The Liaohe River Basin in Liaoning Province has a drainage area of approximately 69,300 km², accounting for 46.9% of the province's total area. It encompasses 60 counties (cities, districts) within 11 prefecture - level cities in the province.

211. As depicted in the above figure, Panjin City is situated at the estuary of the Liaohe River and the Daling River. Due to its special geographical conditions, flood control in Panjin is influenced by three factors: local rainfall, upstream river inflow, and tidal uplift. Panjin features a flat terrain with elevations ranging from 2.2 to 5.0 meters. When the water levels of external rivers like the Liaohe River, Daliao River, and Raoyang River are high, urban drainage cannot be achieved through self - discharge. During 2024, Panjin City issued rainstorm warnings on multiple occasions. For instance, there was a rainstorm blue warning on July 2, a rainstorm orange warning on August 21, and a rainstorm red warning on August 4. Heavy rainfall is highly likely to pose a risk of urban waterlogging. Additionally, on October 21, 2024, five coastal cities in Liaoning Province, namely Dalian, Yingkou, Panjin, Jinzhou, and Huludao, experienced sudden seawater backflow, which led to the flooding of some streets and houses. The terrain of Erjiegou Street in Dawa District, Panjin City is low - lying, and there are tidal gullies formed by the repeated impact of seawater tides around it. The abnormal increase in the water level along the coast of Liaodong Bay this time is caused by the superimposition of storm surge oscillation echoes and astronomical high tide levels, resulting in generally high tide levels along the coast of Liaoning Province.

212. Besides the impact of water volume, the water environment quality in Panjin City is also affected by the upstream watershed. According to the "Overall Plan for Comprehensive Management and Ecological Restoration of the Liaohe River Basin" of the Liaoning Provincial People's Government, the Liaohe River Basin has issues such as excessive development of water resources, low environmental carrying capacity, severe pollution, ecosystem degradation, and insufficient flood control capacity in some river sections. The cumulative effect of the ecological environment has made the above - mentioned problems more prominent in the Panjin area. The details of the water environment quality will be further elaborated in 5.4.3.

213. There are 21 large, medium and small rivers in Panjin City, with a total length of 634 km and a total drainage area of 3,570 km². Among them, there are 4 large rivers: Liaohe River, Daliaohe River, Raoyang River, Dalinghe River; 17 small and medium rivers. The overall water network density is about 0.35km/km², and the density of typical water network dense areas reaches 4.2km/km²; the average inflow of water resources over the years is 7.204 billion m³.

214. The project area belongs to the Liaohe River Basin, Liaohe river has 116 km long in Panjin City (from Liujianfang to the estuary), with a basin area of 2,438.38 km². The river system in the project area is mainly composed of natural rivers such as the Liaohe River and its tributaries and artificial rivers such as canals:

215. Yitong River is located in the urban area of Shuangtaizi District, Panjin City. It has an average width of about 45m and flows from east to west into the Liaohe River. Its catchment area is 55.6 km² and it

flows from east to west into the Liaohe River.

216. The Huancheng water system is located in the urban area of Xinglongtai District, Panjin City. It has an average width of about 20m and a catchment area of 15.3 km². It flows from east to west into Pangxieyou River.

217. Pangxieyou River is located in the urban area of Xinglongtai District, Panjin City. It has an average width of about 35m and flows into the Liaohe River from east to west. The catchment area is 99.4 km² and it flows into the Liaohe River from east to west.

218. Qingshui River is located in Tianjia Sub-district, Dawa District, Panjin City. It has an average width of about 30 meters and flows from east to west into the Liaohe River. Its catchment area is 51.2 km² and it flows from east to west into the Liaohe River.

219. Zhaoquan River is located in the main urban area of Dawa District, Panjin City. It has an average width of about 20m and flows from east to west into the Liaohe River. Its catchment area is 42.3 km² and it flows from east to west into the Liaohe River.

220. Water quality of the Panjin section of the Liaohe River: the water quality of the two sections of Xing'an and Shuguang Bridges meets the Class III standard, the water quality of the Panjin section of the Liaohe River and the Zhaoquan River section of the main stream meets the Class IV standard; the water quality of five sections of the six main tributaries, including the Xiaoliuhe Zhabei Bridge, Yitonghe Zhonghua Road Bridge, Taipinghe Xinsheng Bridge, Raoyanghe Shenglitang and Qingshuihe Sluice, meets the Class IV standard, and the water quality of the Pangxieyou Yugangzi section meets the Class V standard, all of which have reached the corresponding assessment targets 9.



Source: Project FSR, August 2024

Figure 5-7 Current water system map

221. The groundwater sources in the project area are divided into Quaternary groundwater and Upper Tertiary groundwater, and the groundwater types are divided into loose rock pore water and clastic rock pore fissure confined water. The groundwater flows roughly from north to south, which is consistent with

⁹ [Panjin City Environmental Quality Bulletin 2022 - Environmental Protection - Panjin Municipal People's Government \(panjin.gov.cn\)](http://panjin.gov.cn)

the direction of surface water runoff. The area mainly receives vertical infiltration recharge from atmospheric precipitation, as well as lateral recharge from rivers such as Liaohe River and Raoyang River. The aquifer in the evaluation area changes from thin to thick from north to south, from east to west to the middle, and the lithology changes from single to complex, the particles change from coarse to fine, the water volume changes from large to small, and the water level depth changes from more than 5m to 1-3m. The groundwater in the area is mainly found in the pores of marine deposits, marine silt, fine silt, fine sand, and gravel, covered by 0.5~5m of silty sub-clay and sub-sand layers, and the saline water layer is 70~360m thick. The main types include brackish water, salt water. The groundwater level is buried at a depth of 0.5~3.0m, which is phreatic to slightly pressurized water, with a permeability coefficient of 8~14m/d and a single water inflow of 100~1000m³/d, identified as moderate water abundance area.

5.2 Ecological environment

222.The ecological environment survey of the project area adopts data collection method, field investigation method, remote sensing and geographic information system (GIS) analysis method to analyze the current status of the project and the surrounding natural environment.

5.2.1Habitat type

223.This section uses the “Third National Land Survey Results of Panjin City” to conduct a spatial analysis of land use types to understand the habitat patterns and characteristics of (1) Panjin City and (2) the project site and its surrounding areas.

(1) Analysis of habitat types in Panjin City

224.According to the "General Plan of Panjin Urban - rural Spatial Development (2021 - 2035)", the overall spatial pattern of Panjin City is divided into three parts. From west to east, they are (I) ecological conservation and tourism development area; (II) urban industrial development area; (III) agricultural development area.



Source: ESIA Consultant Nov 2024

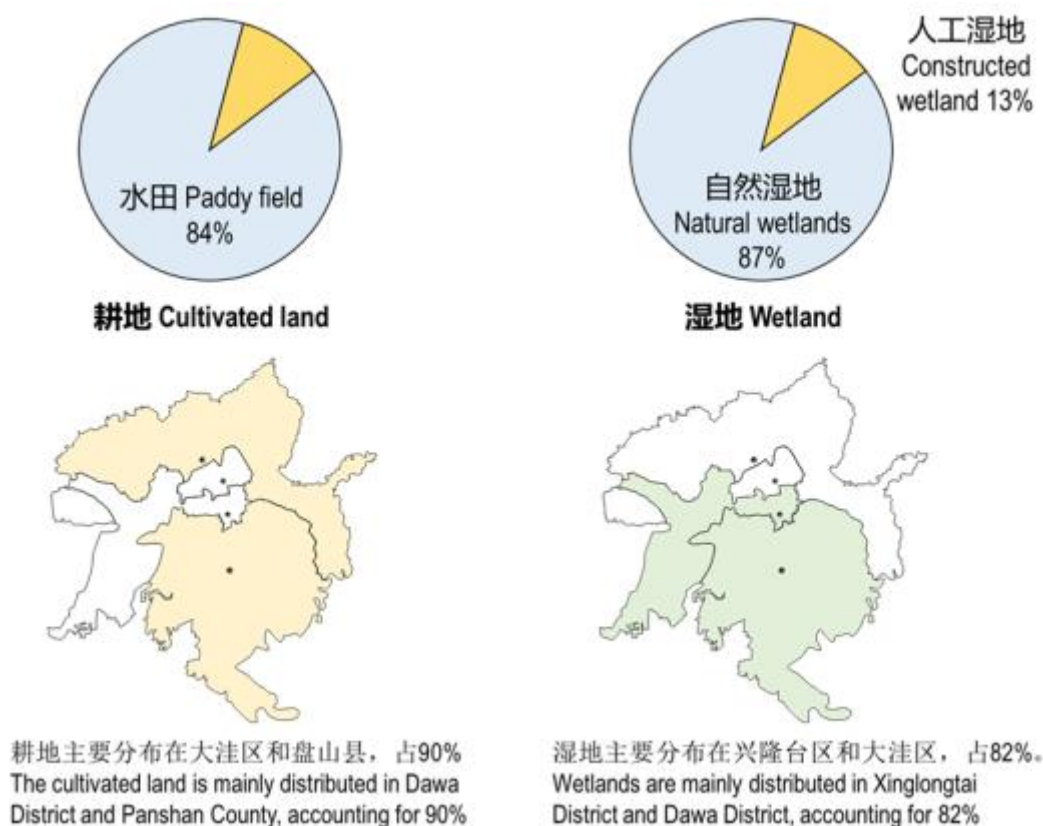
Figure 5-8 Panjin City Image Map and Spatial Pattern Planning Map

225.In terms of habitat characteristics, according to the data of Panjin Natural Resources Bureau and Panjin Statistics Bureau, the current land types in Panjin are mainly cultivated land, wetlands, water areas and water conservancy facilities land, towns and villages, and industrial and mining land, as shown in the following table and figure.

Table 5-1 Main data of the third national land survey in Panjin City

Land use type	Area (hectares)	Proportion
arable land	157049.29	39%

Wetlands	103191.37	25%
Water area and water conservancy facilities land	69324.94	17%
Towns, villages and industrial and mining land	49642.41	12%
Land for transportation	9776.66	2%
grassland	7712.11	2%
woodland	7565.85	2%
Plantation land	975.22	0%
total	405237.85	100%



Source: ESIA Consultant Nov 2024

Figure 5-9 Distribution of cultivated land and wetlands in Panjin¹⁰¹¹¹²

226. Based on the above development status and spatial layout, the overall habitat pattern of Panjin City is also composed of three parts:

227. (I) The habitat corresponding to the Western Ecological Conservation and Tourism Development Zone is centered on the wetland ecosystem. The region is rich in wetland resources, such as vast reed marshes and numerous river and lake systems, forming a variety of habitat types, providing habitats for many rare species, and is of great significance in ecological services such as water conservation and climate regulation. It also promotes tourism development with its unique wetland landscape.

¹⁰ https://zrzyj.panjin.gov.cn/2022_03/04_09/content-364294.html

¹¹ <https://www.forestry.gov.cn/main/586/20220831/103405764487644.html>

¹² Li Jiai Survey and SWOT Analysis of Urban Wetland Resources in Panjin City [J] Inner Mongolia Forestry Survey and Design, 2021,44 (01): 43-45+82. DOI: 10.13387/j.cnki.nmld.2021.01.016



Source: ESIA Consultant Nov 2024

Figure 5-10 Typical habitats in the Panjin Western Ecological Conservation and Tourism Development Zone

228.(II) The habitat pattern of the central urban industrial development zone is diverse. Artificial green spaces and parks in urban built-up areas create habitats for urban organisms. Panjin's parks are basically built along water, including artificial wetlands. Channels and water surfaces in urban areas are also important components of the water system ecological pattern. The buffer zone habitat formed by planned restoration around industrial parks uses suitable green plants to reduce the impact of industrial activities on the ecology and maintain a balance between development and protection.



Source: ESIA Consultant Nov 2024

Figure 5-11 Typical habitats in the central urban industrial development zone of Panjin

229.(III) Habitats in the Eastern Agricultural Development Zone. Large tracts of farmland, together with ditches and ponds, form an agricultural ecosystem, providing living conditions for field organisms and forming a relatively stable habitat system with crops. The preserved woodlands and grasslands enrich the habitat diversity.



Source: ESIA Consultant Nov 2024

Figure 5-12 Typical habitats in the eastern agricultural development zone of Panjin

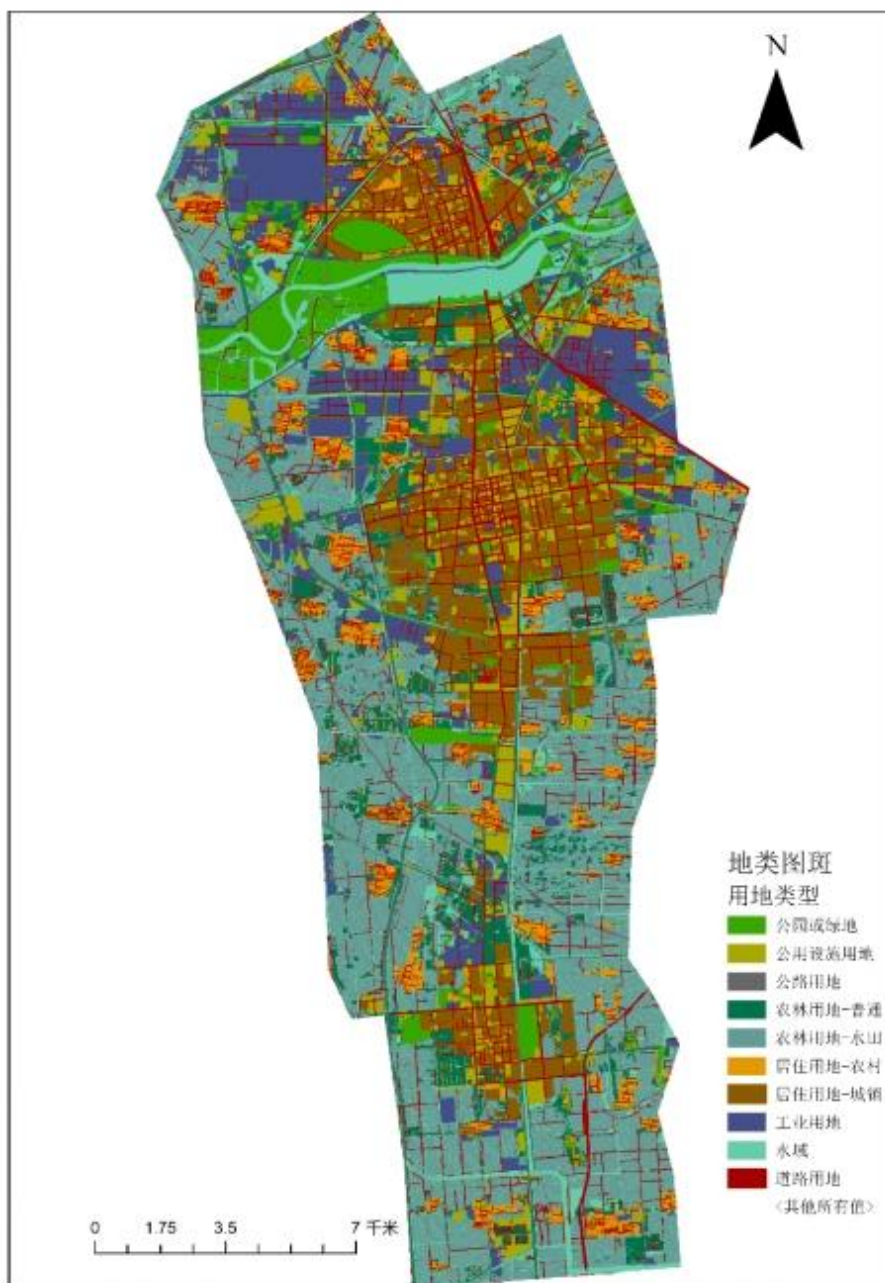
(2) Analysis of habitat types in Project location

230.As shown in the figure below, this project is mainly located in the urban area, which is the (II) urban industrial development zone planned in the "Panjin City Land and Space Master Plan (2021-2035)". The land use classification data comes from the results of "The Third National Land Survey In Panjin City". This section uses spatial analysis of land use types to analyze the habitat types in the project area and its surroundings, as shown in the figure below.



Source: ESIA Consultant Nov 2024

Figure 5-13 Location of the project in Panjin City



Source: FSR

Figure 5-14 Current land use distribution in the third national land survey in Panjin City

Table 5-2 habitat type statistics

No.	Land name	Land area (hm ²)	Proportion of urban construction land (%)
1	Road land	1653.11	5.00%
2	Industrial land	3428.13	10.37%
3	Highway land	886.76	2.68%
4	Public utility land	2098.74	6.35%
5	Park or green space	2297.02	6.95%
6	Residential land-town	3729.61	11.28%
7	Residential land-rural	2282.17	6.90%
8	Agricultural and forestry land-ordinary	3104.13	9.39%
9	Agricultural and forestry land-paddy field	9809.02	29.66%

No.	Land name	Land area (hm ²)	Proportion of urban construction land (%)
10	Waters	3782.35	11.44%
11	Urban construction land	33071.04	100.00%

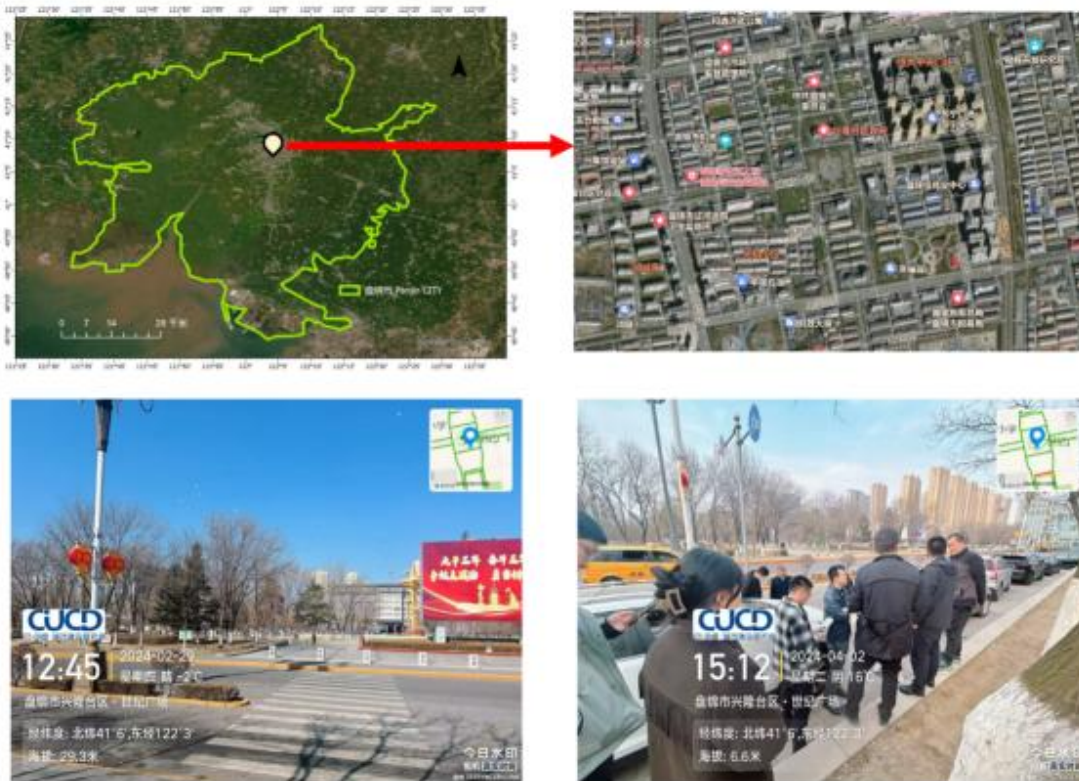
231.As can be seen from the chart, within the scope of the project, the habitats are mainly urban residences, industrial land, and paddy fields. The wetlands involved in this project are all urban green spaces and artificial wetlands in the (II) urban development zone. The artificial wetlands (reed fields, ditch water surface) within the scope of the ecological project land occupation represented by the "Liaohu Stele Forest Park Wetland Restoration and Improvement Project" are shown in the figure below.



Source: ESIA Consultant Nov 2024

Figure 5-15 Location and status of the Liaohu Beilin Park wetland restoration and improvement project

232.The habitat types in the infrastructure project areas such as pipelines, pump stations, and roads in this project are mainly artificial green vegetation systems. These artificial green vegetation have been planned and laid out to simulate some functions of natural habitats to a certain extent, providing certain support for biodiversity in the area. Take the "Renovation Project of Waterlogged Points Near Century Square" as an example, as shown in the figure below.



Source: ESIA Consultant Nov 2024

Figure 5-16 Location and status of the flood-prone area reconstruction project near the Shiji Square

5.2.2 Flora

233. This section will analyze the flora characteristics at two levels: (1) Panjin City, and (2) the project site and surrounding areas.

(1) Plant distribution and flora in Panjin City

234. As can be seen from Section 5.2.1, the habitat pattern of Panjin City mainly includes three parts. For the (I) ecological conservation and tourism development area, the main vegetation in this area includes *Populus simonii*, *Tamarix shrub*, *Nitraria tangutorum shrub*, *Reed community*, *Gramineus chinensis community*, *Apocynum venetum community*, *Leymus chinensis community*, *Reed meadow*, *Croton tiglium community*, *Pinus fusoni community*, *Suaeda salsa annual halophytic grassland*, *Reed swamp*, *Cattail-reed swamp*, *Sugarcane swamp*, *Cattail swamp*, *Foxtail algae community*, etc. The typical vegetation in the (I) ecological conservation and tourism development area is shown in the figure below.



Suaeda salsa



reed

Source: ESIA Consultant Nov 2024

Figure 5- 17 Typical vegetation in the ecological conservation and tourism development zone of Panjin City

235. The main characteristics of this type of vegetation community are natural succession, and the succession process is as follows: the sea retreat and river sedimentation in Liaodong Bay are relatively fast, and the process of plant community succession is directly affected by changes in water and salinity. Plant community succession begins with coastal saline bare land, which has a high salt content due to long-term seawater infiltration and only grows algae. With the retreat of seawater, the uplift of land and leaching, the salinity decreases, and salt-tolerant annual plants such as *Suaeda salsa* are the first to settle and form a pure community. Later, as the soil salinity further decreases, *Pinus japonica*, *Croton tiglium* and other plants invade one after another, forming *Croton tiglium* salt meadows, and the soil properties also change. At the same time, in areas with different waterlogging conditions, reeds will formulate reed meadows, reed swamps, etc. As the sea water continues to recede, the terrain rises and the groundwater level drops, the reed marsh evolves into reed meadow, *Leymus chinensis* meadow, *Imperata cylindrica* meadow and Ox tongue grass meadow in sequence. The soil salinity drops to below 0.2% to form meadow soil, presenting a process driven by river accumulation and sea retreat, and the plant community evolves with changes in water and salinity.

236. For the (II) urban industrial development zone where this project is located, its flora is mainly affected by artificial planting, showing the following characteristics: For urban road greening and park green space, there are mainly *Sophora japonica*, *Ailanthus altissima*, *Fraxinus chinensis*, poplar, etc. In the early days of the city, due to the high groundwater level, high degree of salinization and low humus content in Panjin, native tree species such as poplar, willow, elm and *Sophora japonica* were generally planted. Later, in order to improve the green landscape effect of the city, Panjin City appropriately introduced tree species such as *Ginkgo biloba* and black pine. Nearly 40 plants¹³ such as white pine and spruce were also used in the greening construction of Xianghai Avenue. For artificial wetland parks in the city, the main vegetation includes reeds, barnyard grass, long-awned barnyard grass, quinoa, ear grass, etc. Other urban green spaces mainly use plants such as Manila turf.

237. For (III) agricultural development zone, the vegetation type is mainly crops, among which rice is the main crop. The annual rice planting area in Panjin City is about 1.6 million mu¹⁴. Generally, seedlings start to be raised around mid-April, and rice seedlings start to be planted in mid-to-late May. After several months of growth, harvesting begins around October. Other crops include alkaline persimmons, etc.

(2) Project site and surrounding areas

238. As for the vegetation in the project site and its surrounding areas, according to field surveys, no national key protected wild plants were found within the project area, and no natural forests were found in the project area. The project is located within the urban development boundary. Due to long-term human activities, there are relatively few wild plant species, most of which are common species in human settlements, mainly artificially planted greening tree species and their associated or naturally growing shrubs and herbs. Most of the trees are warm temperate vegetation, mainly forest networks and street trees.

239. For wetland restoration and park landscape projects, take the "Liaohu Sluice Park Ecological Restoration and Improvement Project" and the "Hundred-acre Lotus Pond Ecological Restoration Project" as examples, see Figure 5-18. Common plants such as poplar and reed are distributed in and around the project site. Other plants include herbaceous plants such as *Lepidium*, *Phragmites australis*, *Echinochloa crus-galli*, *Echinochloa foetida*, *Chenopodium album*, Ear grass, *Potentilla cinerea*, and *Osmanthus sinensis*.

¹³ https://zjj.panjin.gov.cn/2023_08/03_09/content-420779.html

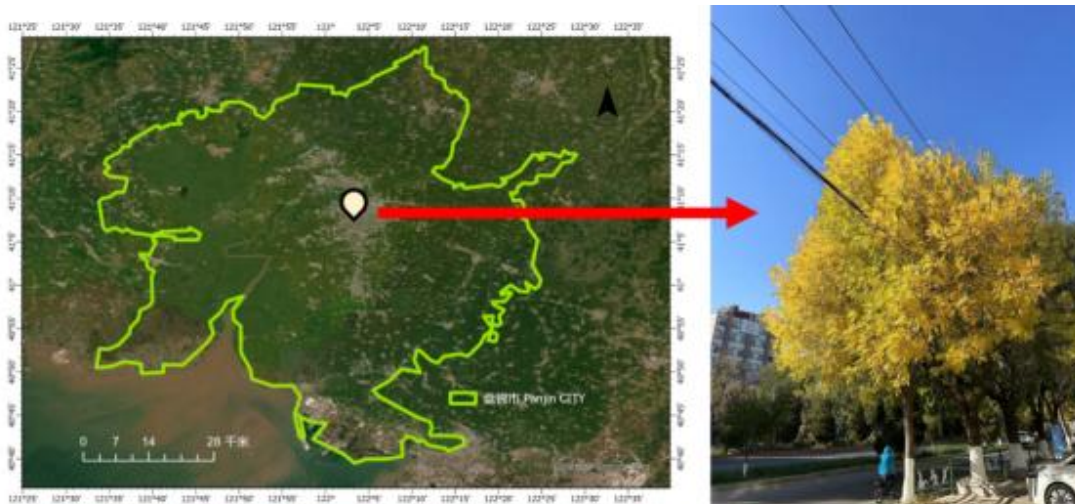
¹⁴ https://nyncj.panjin.gov.cn/2022_10/31_16/content-389949.html



Source: ESIA Consultant Nov 2024

Figure 5-18 Vegetation of wetland restoration and park landscape projects

240. At other project sites such as pump stations and roads, the main vegetation is artificially planted green trees, including elm, locust, pagoda tree, poplar, willow, etc. Take the "Renovation Project of Flood-Prone Areas around the Stadium" as an example, see the figure below.



Source: ESIA Consultant Nov 2024

Figure 5-19 Vegetation around pump stations, roads and other project sites

5.2.3 Fauna

241. This section will analyze the characteristics of the fauna at two levels: (1) Panjin City, and (2) the

project site and surrounding areas.

(1) Panjin City Area

242. According to the Panjin City Land Space Master Plan (2021-2035), Panjin City is mainly divided into three functional areas from west to east. Among them, the western area (I) ecological conservation and tourism development zone where the Liaohe River estuary is located is the area that best reflects the biodiversity of Panjin City.

243. Panjin is located in the center of the Liaohe Delta, and its wetland resources have a significant impact on biodiversity. The geographical environment where the river and the sea meet has created a vast coastal reed marsh wetland, providing a habitat for many wild animals. The area is rich in biodiversity and is a feeding ground for migrating waterfowl from East Asia to Australasia, a stopover for red-crowned cranes migrating from north to south, a breeding ground for the world's largest black-headed gull population, and a breeding ground for spotted seals. The location of Liaohekou National Wetland Park is shown in the figure below.

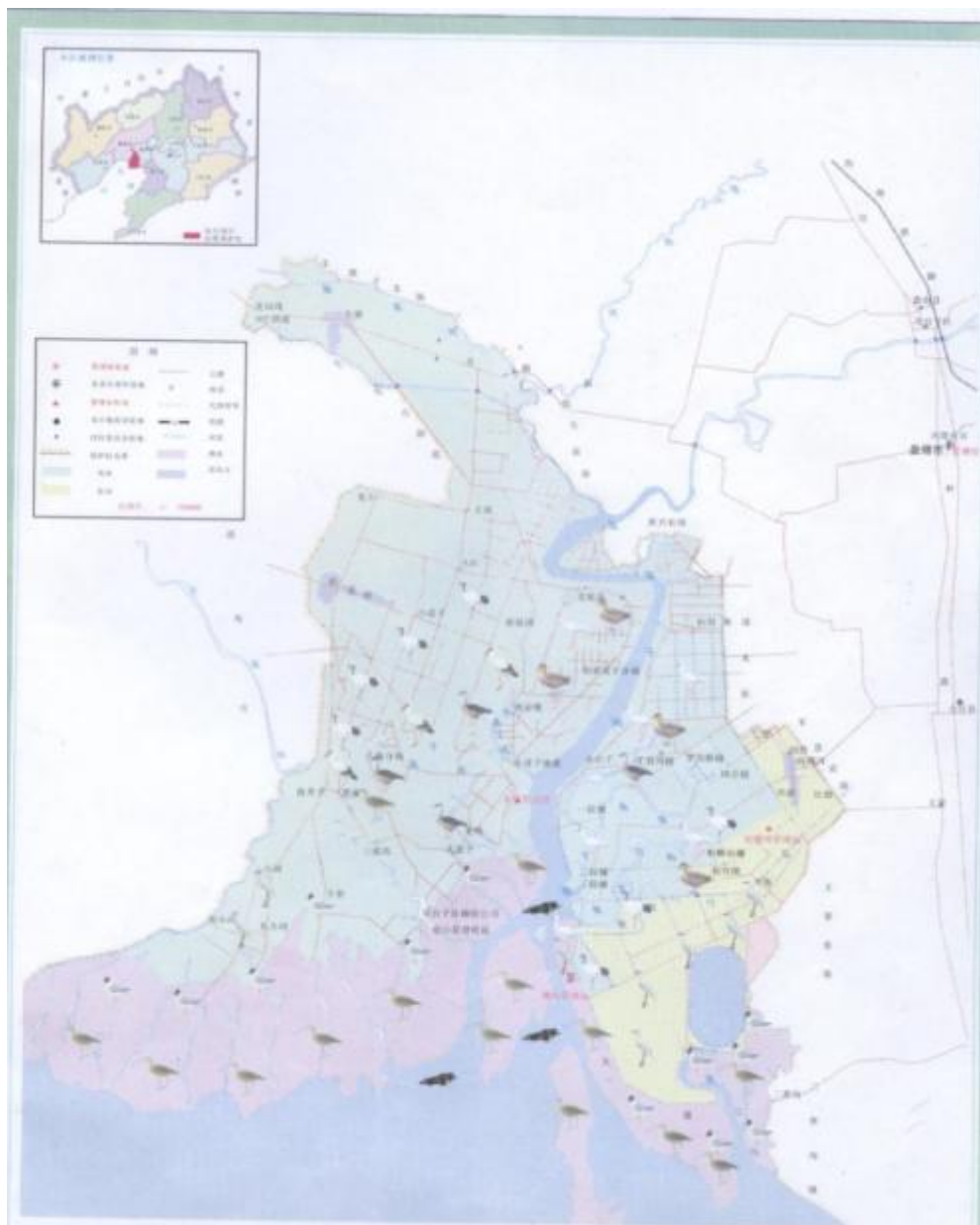


Source: ESIA Consultant Nov 2024

Figure 5-20 Location of Liaohekou National Reserve

244. There are 452 species of wild animals distributed in Panjin Wetland, including 300 species of birds, including the internationally critically endangered species Spoon-billed Sandpiper (population size is only more than 500), as well as 23 species of National Class I protected birds such as red-crowned cranes and white cranes, and 49 species of National Class II protected animals such as grey cranes and whooper swans. Every year, more than one million water birds migrate, stop or breed. It is the breeding ground for the world's largest population of black-headed gulls, an important stopover for red-crowned cranes' north-south migration, the southernmost limit for natural reproduction and the northernmost limit for wintering. It is the most important and most concentrated stopover for the mainland population of red-crowned cranes migrating northwards. The estuary of the Liaohe River is also an important birthing ground for spotted seals, with more than 300 spotted seals living there in 2021.

245. The Panjin Forestry Bureau and related departments have monitored key birds in the Panjin area and produced a key bird distribution map, as shown below. Most of the important birds in Panjin, such as the red-crowned crane, are distributed around the Liaohekou Wetland.



Source: Panjin Forestry and Wetland Bureau

Figure 5-21 Distribution map of key bird species in Panjin City

(2) Project site and surrounding areas

246. The project site is located in the urban industrial development zone of Panjin City, about 15km away from the mouth of the Liaohe River. According to the on-site investigation of the ESIA unit, as well as the "Panjin Wetland Protection Master Plan" (2020~2025), "Panjin Liaohekou Provincial Nature Reserve Comprehensive Scientific Investigation Report" and other literature materials, in the project evaluation area, except for frogs, gray doves, house swallows, sparrows, magpies, hedgehogs, toads, and toads listed in the "National List of Terrestrial Wildlife with Important Economic and Scientific Research Value" (i.e. "Three Animals"), no national or local protected species were found. The characteristics of various fauna in the project area are as follows.

247. As for aquatic life, the evaluation area of this project is far from the estuary, and there are no echinoderms. The fish are only freshwater fish, and crustaceans, mollusks and zooplankton are also species that survive in freshwater environments.

248. In terms of terrestrial organisms, the species of wild mammals in the assessment area are relatively simple, mainly rodents, with the main species being brown voles (*Microtus mandarinus*) and foremost voles (*Microtus fortis*). In general, the resources of wild mammals in the assessment area are relatively

scarce. The amphibian fauna has one distribution type, which is relatively simple. The main amphibians and reptiles are flower-backed toads (*Bufo*), common toads (*Bufo*), black-spotted frogs (*Kanigromaculata*), toads, etc.

249. Birds can be divided into the following three categories according to the bird habitats and ecological groups involved in the project:

250. Wetland and estuary reed swamp bird ecological groups: This bird group is distributed in the reed growing area of the project evaluation area such as the "Liaohe Stele Forest Park Wetland Restoration and Improvement Project", which is also an area of freshwater and shallow water. In addition to dense reeds, there are also duckweed, three-cornered grass, cattail, etc. The representative species of the bird group in this area include gray magpie, great reed warbler, little egret, little grebe, wind-headed lapwing, common tern, brown-headed parrotbill, etc. The great reed warbler is the dominant species in summer.

251. the evaluation areas of Donghua Road rainwater pipe network and pump station construction projects on both sides of the road and in artificial forest areas. Representative species include gray magpie, common magpie, shrike, etc.

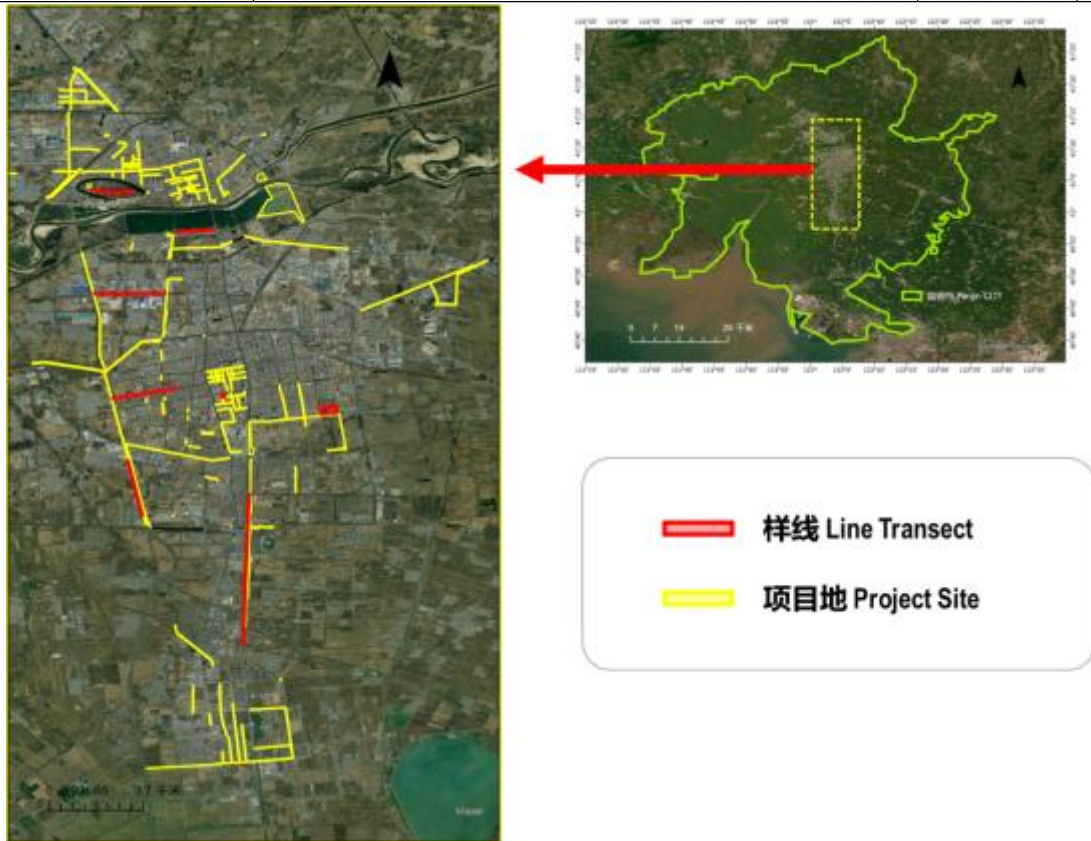
252. Birds along rivers and ditches: mainly distributed along rivers, ditches, pond banks and farmland areas. Representative species include egrets, great egrets, pond herons, common kingfishers, etc. Representative projects include "Nanhuan Water System, Crab Ditch, Shangfang Main Canal Greenway Project", etc.

253. Communicated with the Panjin Forestry Bureau and obtained the monitoring survey data of wintering birds conducted by the Forestry Bureau from January 15 to January 26, 2024. There are 10 sample lines in this survey, with a total length of 37.24 km and a survey area of 1.862 km²; there is 1 sample point, with a survey area of approximately 0.045 km², and a total area of 1.907 km². The survey sample lines are shown in Table 5-2, and the location relationship between the survey sample lines and this project is shown in Figure 5-22.

Table 5-3 List of survey sample strips and points

Sample line number	Place	Habitat description	Length of sample line (km)	Area (km ²)
Rural sample line				
1#	Hongqi Work Area	Main tree species: elm, locust, poplar, willow, ash. Planted at equal distances, with a breast diameter of 12-25cm, a height of 8-13m, and a coverage rate of 88%.	4.07	0.2035
2#	Forest Park	Main tree species: elm, locust, poplar, willow, ash. Mixed natural planting, DBH 5-25cm, height 6-14m, coverage 80%.	4.12	0.206
Urban sample line				
3#	Avenue to the Sea	Main tree species: elm, locust, pagoda tree, poplar. Mixed natural planting, diameter at breast height 5-25cm, height 6-14m, coverage rate 70%.	4.8	0.24
4#	Liaohe Forest of Steles	Main tree species: black pine, spruce, fir, juniper, elm, locust, poplar, willow, ash. Mixed natural planting, DBH 5-25cm, height 6-14m, coverage rate 60%.	5.15	0.2575
5#	Cambridge Park	Main tree species: poplar, willow, elm, locust, ash. Mixed natural planting, DBH 5-25cm, height 6-14m, coverage rate 55%.	2	0.1
6#	Liaohe Wetland Park	Main tree species: elm, locust, pagoda tree, poplar, willow. Natural planting, diameter at breast height 5-20cm, height 5-13m, coverage rate 60%.	3.97	0.1985
			2.9	0.145
7#	Zhonghua Road	Main tree species: elm, locust, pagoda tree, poplar, willow. Natural planting, diameter at breast height 5-40cm, height 5-16m, coverage rate 70%.	2.8	0.14
8#	Whitby Street	Main tree species: <i>Koelreuteria paniculata</i> , Xinjiang poplar, sycamore, <i>Sophora japonica</i> , poplar. Regular + natural planting, DBH 5-28cm, height 5-18m, coverage rate 48%.	3.93	0.1965
9#	Pipeline Street	Main tree species: <i>Fraxinus chinensis</i> , Elm, Poplar, Willow, <i>Robinia pseudoacacia</i> . Regular + natural planting, DBH 5-45cm, height 5-25m, coverage 80%.	3.5	0.175

10#	Municipal Party Committee Building	Main tree species: Fraxinus chinensis, Sophora japonica, Poplar, Juniper, Willow. Natural planting, DBH 10-20cm, height 10-15m, coverage rate 50%.		0.045
total			37.24	1.907



Source: ESIA Consultant Nov 2024

Figure 5-22 Relationship between bird survey sample line and project location

254.As can be seen from the above figure, the sample line set up for this survey is close to the project area, so the survey results can better reflect the characteristics of birds in this project area. The survey results are summarized as follows.

255.This survey recorded 24 bird species (see Table 3), belonging to 6 orders and 16 families. Among them, there is one species of national second-class protected bird, the red kestrel (*Falco tinnunculus*). Two new species were recorded, the Eurasian tree creeper (*Certhia familiaris*), the wintering population density was 8.91 per km², and the northern rosefinch (*Carpodacus roseus*) was only recorded once in Liaohe Wetland Park, with eight individuals.

256.According to residence status: there are 12 species of resident birds, accounting for 50.00%; 10 species of winter migratory birds, accounting for 41.67%; 1 species of migratory birds, accounting for 4.17%; and 1 species of summer migratory birds, accounting for 4.17%.

257.According to the survey, winter migratory birds are mainly composed of Parus, Parus, Passeriformes, and Buntings, among which Passeriformes have the most species, including 11 families and 17 species, accounting for 70.83% of the recorded bird species; resident birds are mainly composed of Phasianidae, Columbidae, Woodpeckers, Corvidae, Oriole, and Passeriformes. The population is relatively large and the frequency of appearance is also relatively high. For example, the number of sparrows was 773 with a frequency of 36 times, the number of gray magpies was 448 with a frequency of 21 times, and the number of magpies was 213 with a frequency of 36 times.

Table 5-4 Statistics of bird species in Panjin city in winter 2024

Order	Galliformes	Columbiformes	Pelecaniformes	Woodpeckers	Falconiformes	Passeriformes
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division	1	1	1	1	1	11
kind	1	2	1	2	1	17
%	4.17	8.33	4.17	8.33	4.17	70.83

Table 5-5 List of bird species in Panjin City during the winter survey in 2024

No.	Species	scientific name	Order	division	Residence	Total quantity (pcs)	Frequency (times)	Density (pcs/km ²)
1	Ring-necked Pheasant	<i>Phasianus colchicus</i>	Galliformes	Phasianidae	Resident birds	1	1	0.52
2	Mountain dove	<i>Streptopelia Oriental</i>	Columbiformes	Columbidae	Resident birds	50	6	26.22
3	Spotted Dove	<i>Streptopelia chinensis</i>	Columbiformes	Columbidae	Resident birds	11	4	5.77
4	Night Heron	<i>Nycticorax nycticorax</i>	Pelecaniformes	Ardeidae	Summer bird	11	1	5.77
5	Great Spotted Woodpecker	<i>Dendrocopos major</i>	Woodpeckers	Woodpeckers	Resident birds	14	10	7.34
6	Grey-headed Woodpecker	<i>Picus canus</i>	Woodpeckers	Woodpeckers	Resident birds	15	10	7.87
7	Kestrel	<i>Falco tinnunculus</i>	Falconiformes	Falconidae	Resident birds	3	3	1.57
8	Gray Magpie	<i>Cyanopica cyanus</i>	Passeriformes	Corvidae	Resident birds	448	twenty one	234.92
9	Magpie	<i>Pica pica</i>	Passeriformes	Corvidae	Resident birds	213	36	111.69
10	Coal Tit	<i>Periparus ater</i>	Passeriformes	Tit	Winter bird	3	2	1.57
11	Big tits	<i>Parus cinereus</i>	Passeriformes	Tit	Winter bird	127	33	66.6
12	White-headed Bulbul	<i>Pycnonotus sinensis</i>	Passeriformes	Bulbulidae	Resident birds	2	1	1.05
13	Northern Long-tailed Tit	<i>Aegithalos caudatus</i>	Passeriformes	Long-tailed Tit	Winter bird	103	12	54.01
14	Brown-headed Parrotbill	<i>Sinosuthora webbiana</i>	Passeriformes	Oriole	Resident birds	4	1	2.1
15	Eurasian Tree Creeper	<i>Certhia familiaris</i>	Passeriformes	Tree Creeper	Winter bird	17	11	8.91
16	Common Nuthatch	<i>Sitta europaea</i>	Passeriformes	Nuthidae	Winter bird	1	1	0.52
17	Waxbird	<i>Bombycilla garrulus</i>	Passeriformes	Waxwings	Winter bird	20	1	10.49
18	sparrow	<i>Passer montanus</i>	Passeriformes	Finch	Resident birds	773	36	405.35
19	Tin-billed Sparrow	<i>Coccothraustes coccothraustes</i>	Passeriformes	Finch	Winter bird	33	5	17.3
20	Black-tailed Grosbeak	<i>Eophona Migratoria</i>	Passeriformes	Finch family	Winter bird	8	2	4.2
21	Black-headed Grosbeak	<i>Eophona personata</i>	Passeriformes	Finch family	Winter bird	1	1	0.52
22	Northern Redbird	<i>Carpodacus roseus</i>	Passeriformes	Finch family	Migratory Bird	8	1	4.2
23	Small Bunting	<i>Emberiza Pusilla</i>	Passeriformes	Bunting	Resident birds	132	8	69.22

24	Field Bunting	<i>Emberiza rustica</i>	Passeriformes	Bunting	Winter bird	116	1	60.83
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Table 5- 6 Comparison of the number of passerine bird species by year

serial number	Species	scientific name	2022	2023	2024
1	Jay	<i>Garrulus glandarius</i>	1	0	0
2	Gray Magpie	<i>Cyanopica cyanus</i>	688	515	448
3	Red-billed blue magpie	<i>Urocissa erythroryncha</i>	0	1	0
4	Magpie	<i>Pica pica</i>	201	169	213
5	Coal Tit	<i>Periparus ater</i>	0	10	3
6	Big tits	<i>Parus cinereus</i>	48	76	127
7	White-headed Bulbul	<i>Pycnonotus sinensis</i>	32	41	2
8	Chestnut-eared Bulbul	<i>Hypsipetes amaurotis</i>	21	2	0
9	Silver-throated long-tailed tit	<i>Aegithalos glaucogularis</i>	1	1	0
10	Northern Long-tailed Tit	<i>Aegithalos caudatus</i>	0	0	103
11	Brown-headed Parrotbill	<i>Sinosuthora webbiana</i>	70	16	4
12	Chinese Parrotbill	<i>Paradoxornis heudei</i>	12	0	0
13	Eurasian Tree Creeper	<i>Certhia familiaris</i>	0	0	17
14	Common Nuthatch	<i>Sitta europaea</i>	0	1	1
15	Redstart	<i>Turdus naumanni</i>	0	1	0
16	Spotted Thrush	<i>Turdus eunomus</i>	1	0	0
17	Waxbird	<i>Bombycilla garrulus</i>	3	0	20
18	sparrow	<i>Passer montanus</i>	770	1422	773
19	Tree Pipit	<i>Anthus Hodgsoni</i>	8	0	0
20	Tin-billed Sparrow	<i>Coccothraustes coccothraustes</i>	0	1	33
21	Black-tailed Grosbeak	<i>Eophona Migratoria</i>	87	5	8
22	Black-headed Grosbeak	<i>Eophona personata</i>	4	2	1
23	Northern Redbird	<i>Carpodacus roseus</i>	0	0	8
24	White-rumped Redbird	<i>Acanthis Flammea</i>	3	0	0
25	Small Bunting	<i>Emberiza Pusilla</i>	6	23	132
26	Field Bunting	<i>Emberiza rustica</i>	153	50	116
27	Yellow-throated Bunting	<i>Emberiza elegans</i>	1	10	0

258. From the calculation results, it can be seen that the sparrow has the highest population density in the project area, which is 405.35 per km². Taking the bird species with an individual density of more than 50 per square kilometer as the dominant species, there are 7 dominant species in Panjin in winter, including sparrows, gray magpies, magpies, great tits, northern long-tailed tits, small buntings, and field buntings. Great tits and northern long-tailed tits have become new dominant species.

259. Investigations of different woodlands found that bird species in mixed forests (evergreen and deciduous) have a greater dominance. For example, in the Liaohe Stele Forest, there are more wintering night herons. According to the investigation, their feeding point is in the unfrozen river channel of the Yitong River in the southwest. Farmland in the urban-rural fringe and the upper waterline of farmland ditches have become important habitats for brown-headed parrotbill, small thrush and field thrush due to the distribution of reeds.

260. Compared with the survey results in 2023, there are significant changes in Passerine birds, with the addition of Eurasian Tree Creeper, Northern Redbird, and Northern Long-tailed Tit, and there is no obvious change in other bird species.

261. Panjin has implemented a large number of garden greening projects in recent years, and built an urban green space ecosystem with park green space as the main body, road greening as the skeleton, unit courtyard greening as the embellishment, and protective green space as the barrier, forming a plant community with a complex structure of staggered heights and reasonable matching, providing a suitable ecological environment for the habitat of many birds. The tall trees in the urban area, such as poplars, cypresses, peach trees, jujube trees, and ash trees, have become the habitats or feeding places for birds such as white-headed bulbuls, chestnut-eared bulbuls, magpies, gray magpies, turtledoves, and sparrows. The poplars and torch trees around the urban area have also become the habitats and feeding places for owls, woodpeckers, and gray magpies; and the ditches where the urban area meets the farmland grow wet plants such as reeds, which provide a habitat for Chinese parrots, brown-headed parrots, and buntings. In particular, the planting of berry and fruit trees in the city provides food for birds.

5.2.4 Protected Areas

262. According to Article 14 of the Law of the People's Republic of China on the Protection of Wetlands (implemented on June 1, 2022), the government implements hierarchical management of wetlands, and classifies wetlands into important wetlands and general wetlands in accordance with their ecological location, area, and the importance of preserving ecological functions and biodiversity. Important wetlands include national important wetlands and provincial important wetlands, and wetlands other than important wetlands are general wetlands. Important wetlands are classified as ecological protection red line according to law. The list and scope of general wetlands are issued by the local people's governments at or above the county level or their authorized departments. The Criteria for Recognition of General Wetlands in Liaoning Province (2022) stipulates that general wetlands refer to wetlands other than important wetlands (including internationally important wetlands, nationally important wetlands and provincially important wetlands), and that wetlands with any of the following criteria within Liaoning Province can be recognized as general wetlands:

- 1) A single wetland or multiple wetland complex with an area of less than 5,000 hectares that conforms to the characteristics of wetlands and has a strong ecological function or hydrological role;
- 2) Typical representatives of wetland types or endemic types of wetlands within the municipal administrative area;
- 3) Wetlands that serve as important habitats for wildlife under provincial key protection as well as terrestrial wildlife with important ecological, scientific and social values;
- 4) Wetlands with more than 2,000 breeding, wintering and migratory stops of waterbirds of 1 per cent of the total number of multiple or single species flocks;
- 5) Wetlands with representative, rare or regional characteristic plant communities concentrated and distributed;
- 6) Wetlands with scientific research, popularization of science and education, history and culture, and ecotourism value.

263. According to the data provided by the Forestry and Wetland Bureau of Panjin City, the total area of internationally important wetlands in Shuangtaihekou Estuary, Liaoning Province in Panjin City is 128,000 hectares, and the total area of general wetland Yangquan Circle Wetland is 10526.53 hectares. The project site and wetland location are shown in the following figure, and the closest distance between the project site and important wetlands is about 8 kilometers. In addition, after confirmation with the Forestry and Wetland Bureau and the Natural Resources Bureau of Panjin City, there are no natural reserves within the scope of this project and it does not involve ecological red lines.



Source: ESIA Consultant Nov 2024

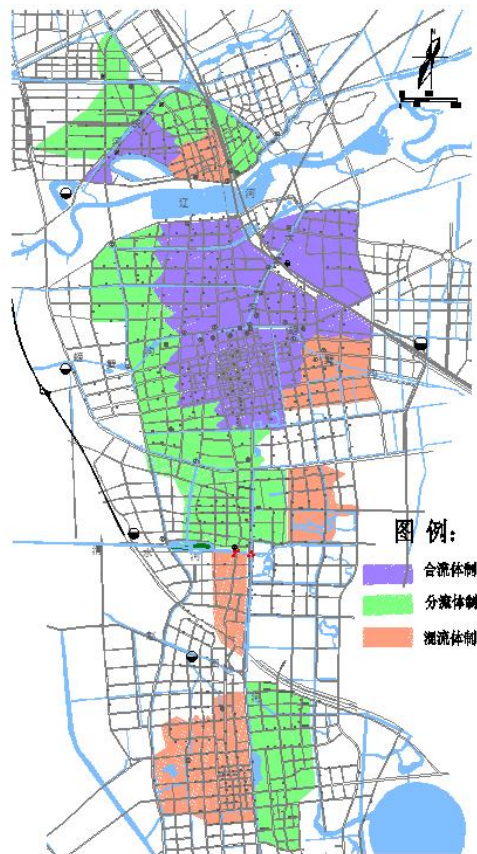
Figure 5-23 Relationship between project site and important wetland locations

5.3 Current status of drainage system

264. At present, Panjin City mainly relies on municipal drainage pumping stations to discharge water into Yitong River, Pangxiegou and Qingshui River respectively. Finally, it is discharged into Liaohe River through Gujia Drainage Station and Yugangzi Drainage Station at the end of Yitong River and Xieyou, and tide gate at the end of Qingshui River.

(1) Drainage system:

265. The current drainage system in Panjin is a combined rain and sewage drainage system. According to the FSR, the combined drainage area is currently concentrated in the central urban areas of Shuangtaizi and Xinglongtai Districts. The separate drainage area is concentrated in the newly built urban area, distributed in the east and west areas in the north of Shuangtaizi urban area, the west of Xinglongtai urban area, the northwest area of Tianjia Sub-district, and the eastern area of Dawa District. The mixed drainage area in the urban area is a drainage form formed by the incomplete transformation of the original combined system, mainly concentrated in the local areas of the combined drainage system in the central urban areas of Shuangtaizi and Xinglongtai, the eastern and southern areas of Tianjia Sub-district where the diversion is not complete, and the western area of Dawa District where the diversion is not complete.



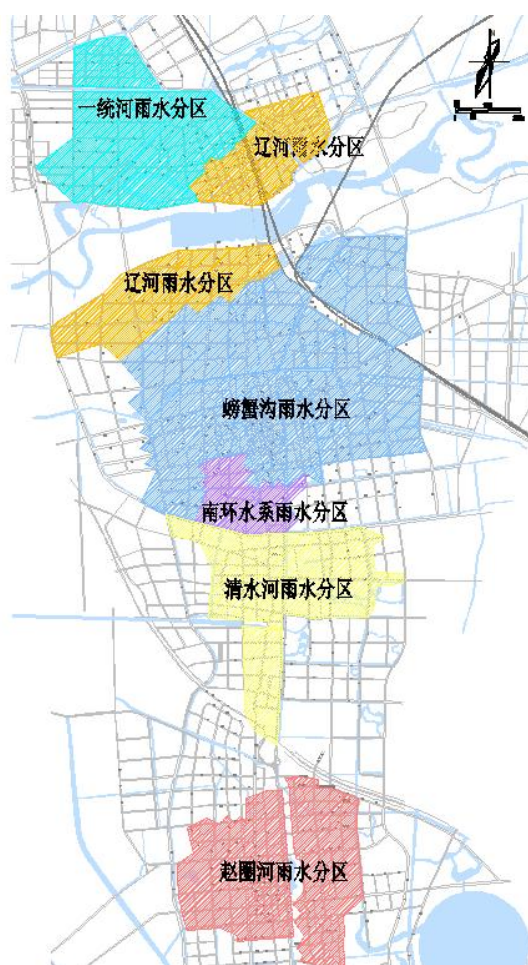
Source: FSR, August 2024

Figure 5-23 Current drainage system in Panjin

266. Panjin's current rainwater and sewage separation system is imperfect, and most of the combined system lifting pump station equipment is aging or even damaged, resulting in the inability to discharge sewage in the pipe network in a timely manner, affecting the discharge capacity of the entire system. Almost all drainage pump stations are built for rainwater and sewage, resulting in a large amount of sewage being discharged into the water body when discharging rainwater, causing water pollution.

(2) Rainwater system:

267. Panjin city is flat, with Yitong River, Liaohe River, Pangxieyou River, Nanhuan Water System, Qingshui River and Zhaoquan River as the main rainwater receiving water bodies in the main urban area. According to the rainwater drainage range of each river, the urban area is divided into 6 major rainwater drainage zones: Yitong River Rainwater Zone, Liaohe River Rainwater Zone, Pangxieyou River Rainwater Zone, Nanhuan Water System Rainwater Zone, Qingshui River Rainwater Zone, Zhaoquan River Rainwater Zone. At present, the urban rainwater drainage in Panjin City relies on pumping stations to lift the drainage.



Source: FSR, August 2024

Figure 5-24 Rainwater zoning map of Panjin City

Table 5-7 Basic information table of rainwater division in Panjin City

No.	Partition name	Number of sub-partitions	Catchment area (km ²)	Administrative region	Receiving water
1	Yitong River Rainwater Division	5	12.5	Shuangtaizi District	Yitong River
2	Liaohe River Rainwater Division	5	15.01	Shuangtaizi District	Liaohe River
3	Pangxiegou River rainwater division	16	65.09	Xinglongtai District	Pangxiegou River
4	Rainwater division of Nanhuan water system	2	18.0	Xinglongtai District	Nanhuan Water System
5	Qingshui River Rainwater Division	3	18.61	Tianjia Sub-district	Qingshui River
6	Zhaoquan River Rainwater Division	5	22.4	Dawa District	Zhaoquanhe

Source: FSR, August 2024

268. The Yitong River rainwater sub-district is under the jurisdiction of Shuangtaizi District. It includes 5 rainwater sub-districts with a total catchment area of 12.5km². The drainage outlet is Yitong River. The drainage system of Shuguang Community Pump Station Sub-district, Gujia Pump Station Sub-district and Weijia Pump Station Sub-district is a mixed rainwater and sewage system, and the drainage system of Chengbei Street Pump Station Sub-district is a separate rainwater and sewage system.

269. The Liaohe rainwater sub-district is under the jurisdiction of Shuangtaizi District. It includes 5 rainwater sub-districts with a total catchment area of 15.01 km². The drainage outlet is Liaohe River. The drainage system of Bayi Pump Station Sub-district, Gaojia Pump Station Sub-district and Lijia Pump Station Sub-district is a rainwater and sewage separation system, while the drainage system of Nanqian Pump Station Sub-district and Liaohe Middle Road Pump Station is a rainwater and sewage mixed flow system.

270. The Pangxiogou River rainwater sub-district is under the jurisdiction of Xinglongtai District. The sub-district includes 16 rainwater sub-districts with a total catchment area of 65.09 km². The drainage outlet is Pangxiogou River. The drainage system of Linfeng Road Pump Station Sub-district and Park Street Pump Station Sub-district is rainwater pipeline, and the drainage system of Xingong Sub-district Pump Station Sub-district, Liaohe South Road Pump Station Sub-district, Oil and Gas Pump Station Sub-district, Shuangxing Pump Station Sub-district, Xinglong Industrial Park Sub-district, Well Logging and Drainage Station Sub-district, Bohai Pump Station Sub-district, Taishan Pump Station Sub-district, Zhuanglin Pump Station Sub-district, Zhongxing Pump Station Sub-district, North District Pump Station Sub-district and East District Pump Station Sub-district is mixed rainwater and sewage system, and the drainage system of Pangxiogou River Pump Station Sub-district and Shihua Road Pump Station Sub-district is separate rainwater and sewage system.

271. The rainwater division of the Nanhuan Water System is under the jurisdiction of Xinglongtai District. It includes two rainwater sub-divisions with a total catchment area of 18.0 km². The drainage outlet is Pangxiogou River. The drainage system of the Xingyou Branch Road Pump Station Division is a rainwater pipeline, and the drainage system of the Shuangxing South Road Pump Station is a mixed rainwater and sewage system.

272. The Qingshui River rainwater sub-district is under the jurisdiction of Tianjia Sub-district. This sub-district includes 3 rainwater sub-districts with a total catchment area of 18.61 km². The drainage outlet is the Qingshui River. All rainwater sub-districts in this sub-district are rainwater pumping stations.

273. Zhaoquan River rainwater sub-district is under the jurisdiction of Dawa District. It includes 5 rainwater sub-districts. The old city to the west includes 3 rainwater catchment sub-districts and the new city to the east includes 2 rainwater catchment sub-districts. The total catchment area is 22.4 km², and the drainage outlet is Zhaoquan River. All 5 rainwater sub-districts in this sub-district are rainwater pumping stations.

274. The layout of Panjin's drainage system is chaotic, the hydraulic conditions in the drainage network are poor, and the capacity of the drainage pumping stations is limited. Some of the equipment in the lifting pumping stations is aging or even damaged, and the designed drainage capacity is insufficient, resulting in the inability to drain rainwater in the network in a timely manner, affecting the discharge capacity of the entire system.

(3) Sewage system:

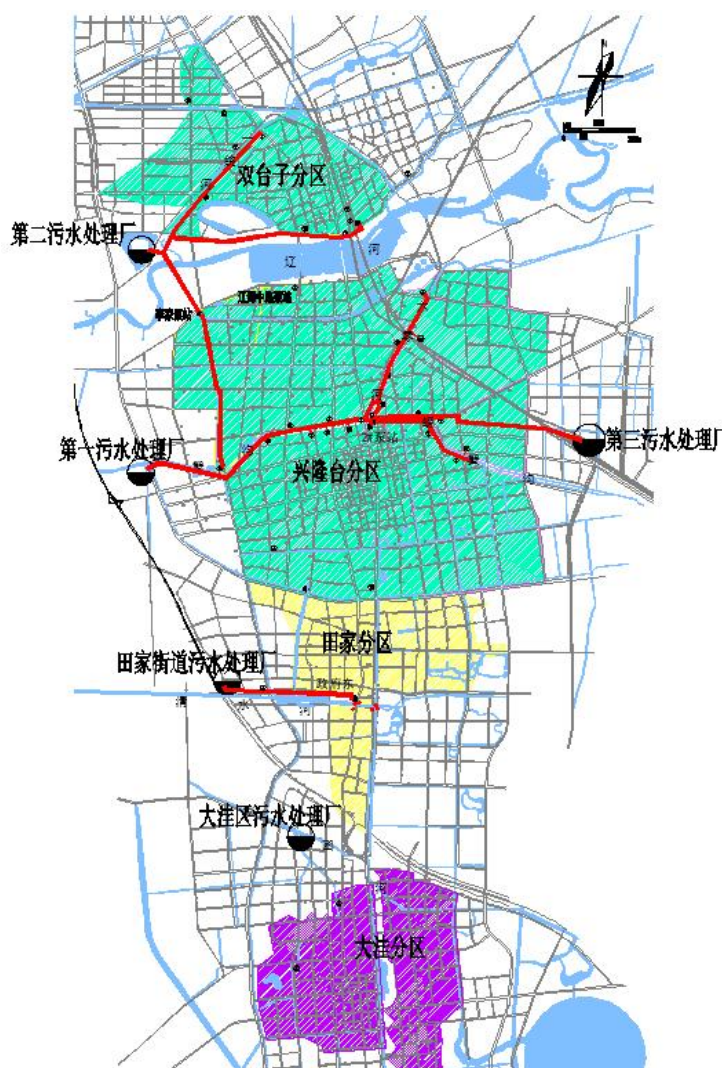
275. The current urban sewage system in Panjin City is divided into three sewage areas according to the administrative area served, namely Shuangtaizi and Xinglongtai sewage areas, countless areas of Tianjianan and Tianjiabei streets, and Dawa District East and Dawa District West sewage areas.

276. There are three municipal sewage treatment plants in operation on both sides of the Liaohe River in Panjin City and in the area north of Huancheng South Road, namely Panjin No.1 Sewage Treatment Plant, Panjin No.2 Sewage Treatment Plant and Panjin No.3 Sewage Treatment Plant. The three sewage treatment plants are not operated independently, but have certain water transfer functions with each other, serving the administrative areas of Shuangtaizi and Xinglongtai Districts. There is one sewage treatment plant in operation in the area south of Huancheng South Road and north of Qingshui River, namely Tianjia Sewage Treatment Plant, serving the administrative area of Tianjia Sub-district. There is one sewage treatment plant in operation in the area south of Zhaoquan River, namely Dawa Sewage Treatment Plant, serving the administrative area of Dawa District.

Table 5-8 Summary of current sewage treatment plants

Sewage Plant	Location	Design scale (10,000 tons / day)	Actual processing capacity (10,000 tons / day)	Catchment area (km ²)	emission Water	Emission standards
The first sewage treatment plant	Pangxiogou River West	10	9.5 ~ 12	61.1	Pangxiogou River	Level A
Second sewage treatment plant	Yitong River Lower Reaches	10	7 to 10	13.9	Liaohu River	Level A
The third sewage treatment plant	Pangxiogou River East	5	4.6 ~ 7	25.3	Pangxiogou River	Level A
Tianjia Wastewater Treatment Plant	Middle and lower reaches of Qingshui River	2.5	2.5	17.9	Qingshui River	Level A
Dawa Sewage Plant	Middle reaches of Zhaoquan River	4	4	22.44	Zhaoquan he	Level A

Source: FSR, August 2024



Source: FSR, August 2024

Figure 5-25 Panjin City Sewage Zoning Map

(4) Drainage network capacity assessment

277. The existing pipe network in Panjin is very old, with low pipe design standards and small designed drainage volume, so the pipe network cannot bear large loads. The FSR uses hydrological and

hydrodynamic methods to simulate the drainage pipes in Panjin's built-up area and evaluate the drainage capacity of Panjin's current drainage pipe network. The FSR evaluates the current situation as follows: The total length of drainage pipes in Panjin's built-up area is 388.5 km, and only 10.23 km of pipes have a recurrence period of 2 years or more, accounting for 2.63%, and there is an urgent need to upgrade the drainage pipes.

(5) Flood risk assessment

278. The FSR adopts the long-term 30-year 24-hour rainfall process line and the predicted 30-year 24-hour rainfall process line in 20 years. Under these two scenarios, the hydrological and hydrodynamic methods are used to simulate the one-dimensional pipe network, the hydraulic power of the river system, and the two-dimensional urban waterlogging inundation to assess the waterlogging risk in Panjin City. The assessment results show that: (1) Under the simulation conditions of the 30-year 24-hour precipitation scenario, under the current conditions, there are 73 flood-prone points in the study area, of which 28 are extremely dangerous and 22 are high-risk areas. (2) Under the simulation conditions of the 30-year 24-hour rainfall (increase of 30%) in 20 years, it can be seen that under the current conditions, the increase of 30% in rainfall in 20 years will make the urban waterlogging problem in Panjin City more serious. The model simulates that the depth of water accumulation has increased and the number of flood-prone points has increased significantly.

(6) Assessment of the current status of drainage pumping stations

279. Panjin's drainage and flood prevention systems are all based on pump station forced drainage, and the sewage collection and treatment is also the sewage from each district is lifted and then enters the sewage interception main pipe. According to statistics, there are 75 major rain and sewage pumping stations in Panjin, and they were built a long time ago. The equipment designed at the time has age limitations. Most of the equipment has high energy consumption, low automation level, and basically relies on manual drive. With the increase in service life, most of the equipment is old and has low operating efficiency. Most of the equipment has tended to be replaced, and there is a risk of normal operation.

(7) Current status of drainage system operation and management

280. At present, Panjin City has not established a digital management platform system for plants, networks, rivers and lakes, and has no assessment of the total amount, quality and efficiency of drainage facilities. The drainage facility management mechanism is imperfect, supervision is not in place, and a unified mechanism for construction, management and service has not been formed. Panjin City still uses relatively primitive means for the approval, construction, acceptance and archiving of drainage facilities, and formulates daily inspection and maintenance plans for pipelines based on experience.

5.4 Environmental Quality Baseline

281. The environmental quality baseline data mainly come from 1) regional environmental quality data published by Panjin Ecological Environment Bureau; and 2) environmental status monitoring results of similar EIA reports near the project site.

5.4.1 Ambient air quality

282. According to the "*Panjin Ecological Environment Quality Bulletin 2023*"¹⁵ published on the official website of Panjin Ecological Environment Bureau (<https://sthjj.panjin.gov.cn/13466/>), in 2023, Panjin City will have 309 days with good ambient air quality. The proportion of days with good ambient air quality in the city is 84.7%.

283. The ambient air quality index (AQI) reached level 1 (excellent) for 115 days, level 2 (good) for 194 days, level 3 (light pollution) for 45 days, level 4 (moderate pollution) for 9 days, level 5 (heavy pollution) for 1 day, and level 6 (severe pollution) for 1 day. Among the days with light pollution or above, the number of days with O₃ as the primary pollutant was the largest, accounting for 51.8%, followed by PM_{2.5} accounting for 30.3%, and PM₁₀ accounting for 17.9%.

¹⁵https://sthjj.panjin.gov.cn/2024_06/07_12/content-475088.html

284. According to the National Environmental Impact Assessment Network Ambient Air Quality Model Technical Support Service System (*Lem.org.cn*), the comprehensive evaluation of Panjin's ambient air quality in 2023 is shown in the following table:

Table 5-9 Regional ambient air quality status evaluation table (basic pollutants)

Pollutants	Annual evaluation indicators	Current concentration/($\mu\text{g}/\text{m}^3$)	Secondary standard value/($\mu\text{g}/\text{m}^3$)	Occupancy rate/%	Compliance
PM _{2.5}	Annual average mass concentration	29	35	83	Meeting standard
PM ₁₀	Annual average mass concentration	48	70	69	Meet the Standard
SO ₂	Annual average mass concentration	10	60	17	Meet the Standard
NO ₂	Annual average mass concentration	28	40	70	Meet the Standard
CO	95th percentile daily average mass concentration	1200	4000	30	Meet the Standard
O ₃	Daily maximum 8-hour average 90th percentile daily average mass concentration	156	160	98	Meet the Standard

5.4.2 Acoustic environment quality

285. According to the Panjin Ecological Environment Quality Bulletin 2023, the road traffic sound environment in Panjin in 2023 is at a good level during the day, of which 79.5% of the total length is at Good level, and 20.5% of the total length is at a General, Poor and Bad level. The regional sound environment is at a good level during the day, and the sound sources are mainly traffic noise and social life noise.

286. According to the project description and environmental impact identification, the evaluation of the acoustic environmental impact of this project focuses on the pipe network renovation projects in Shuangtaizi District, Xinglongtai District, and Dawa District. Such projects are close to sensitive targets such as communities and have many acoustic environmental sensitive targets. Therefore, this project selected the following monitoring points as the evaluation baseline data for the acoustic environmental quality of this project. The monitoring data comes from the Monitoring Center of Panjin Ecological Environment Bureau. The monitoring points are shown in the figure below, and the monitoring results are shown in Table 5-4.



Figure 5-26 acoustic environment monitoring point - Shuangtaizi area



Figure 5-27 acoustic environment monitoring points - Xinglongtai District



Source: ESIA Consultant Nov 2024

Figure 5-28 acoustic environment monitoring point map - Dawa District

Table 5-10 Project Acoustic Environment Quality Monitoring Results Table (dB (A))

Name	Detection Point	Day	Night
Near Shifu Square	1#-Municipal Party Committee	49.8	44.5
	2#-Century Plaza	60.3	46.3
	3#-Panjin Electric Power Bureau	54.6	49
Near Jianshe Primary School, Shuangtaizi District	4 #-QuanJi Hotel South	45.7	51.8
	5 #-Gymnasium	58.3	51.6
	6 #-Supply and Marketing Building	59.5	49.8
Near Yuying Road, Dawa District	7 # ShuangDa JiaYuan	53	38.7
	8 #-Dawa County Heji Jiaju	53.6	40.0
	9 #-Xinglong Sanbai	54.5	45.0
	1 0#-Dawa County Finance Bureau	50.1	43.6
	1 1# -Dawa County Industrial and Commercial Bureau Market Office	55.3	47.6
	1 2#-West Gate of Dawa County Traffic Police Team	51.2	41.7

287.As can be seen from the chart, most of the monitoring point data meet the Class II area standard of the "Environmental Quality Standard for Acoustics (GB3096-2008)", with the equivalent sound level during the day below 60dB and the equivalent sound level at night basically below 50dB. This type of project area is in a densely populated urban area, where social life noise is the main noise source, and some monitoring points have exceeded the standard.

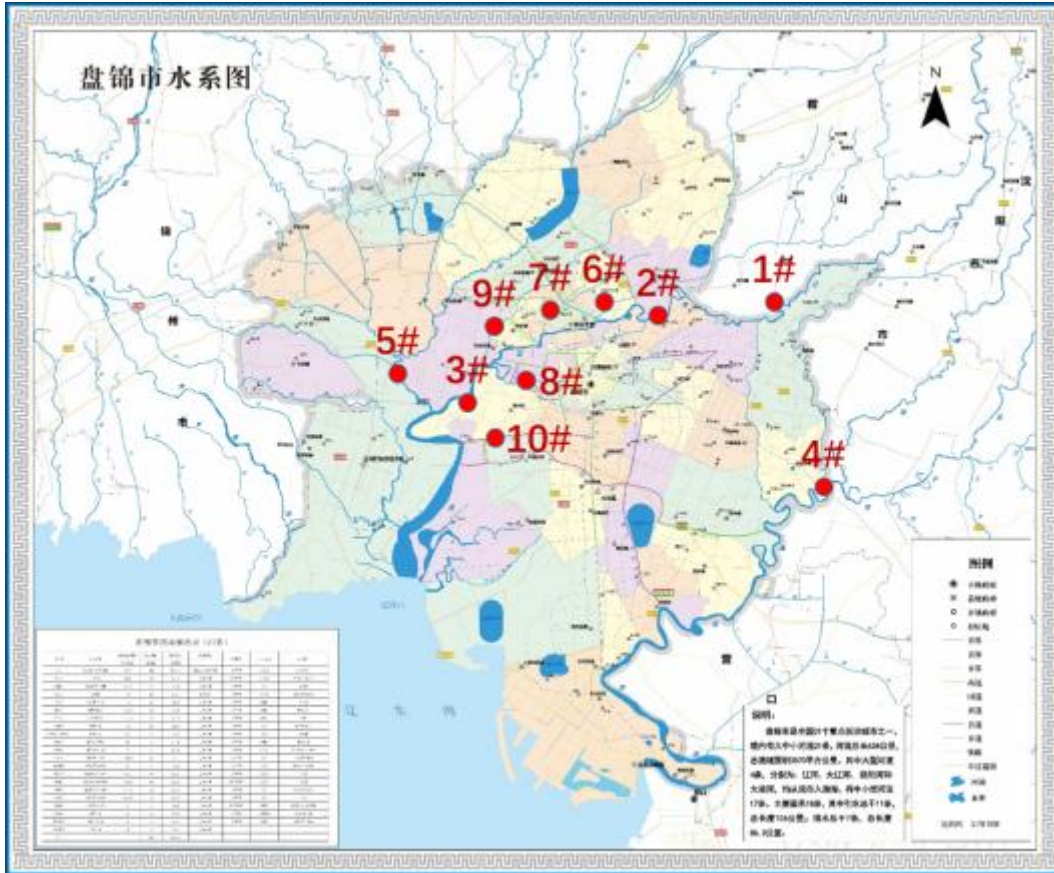
5.4.3 Surface water quality

288.Given the construction characteristics of the project in terms of drainage network and water system connectivity, there is a close relationship between the project and the water environment quality of the basin. In order to achieve a more systematic and comprehensive evaluation of the impact of the project

on the regional water environment, this section will analyze the baseline of regional surface water environment quality at the following two levels: (1) Panjin City, and (2) surface water bodies directly related to the project.

(1) Panjin City

289. current surface water quality monitoring in Panjin City refers to the river water quality monitoring results of Panjin Municipal Ecological Environment Bureau (January 2022 to September 2024). The monitoring points are shown in the figure below.



Source: ESIA Consultant Nov 2024

Figure 5 Map of -30 river water quality monitoring sites

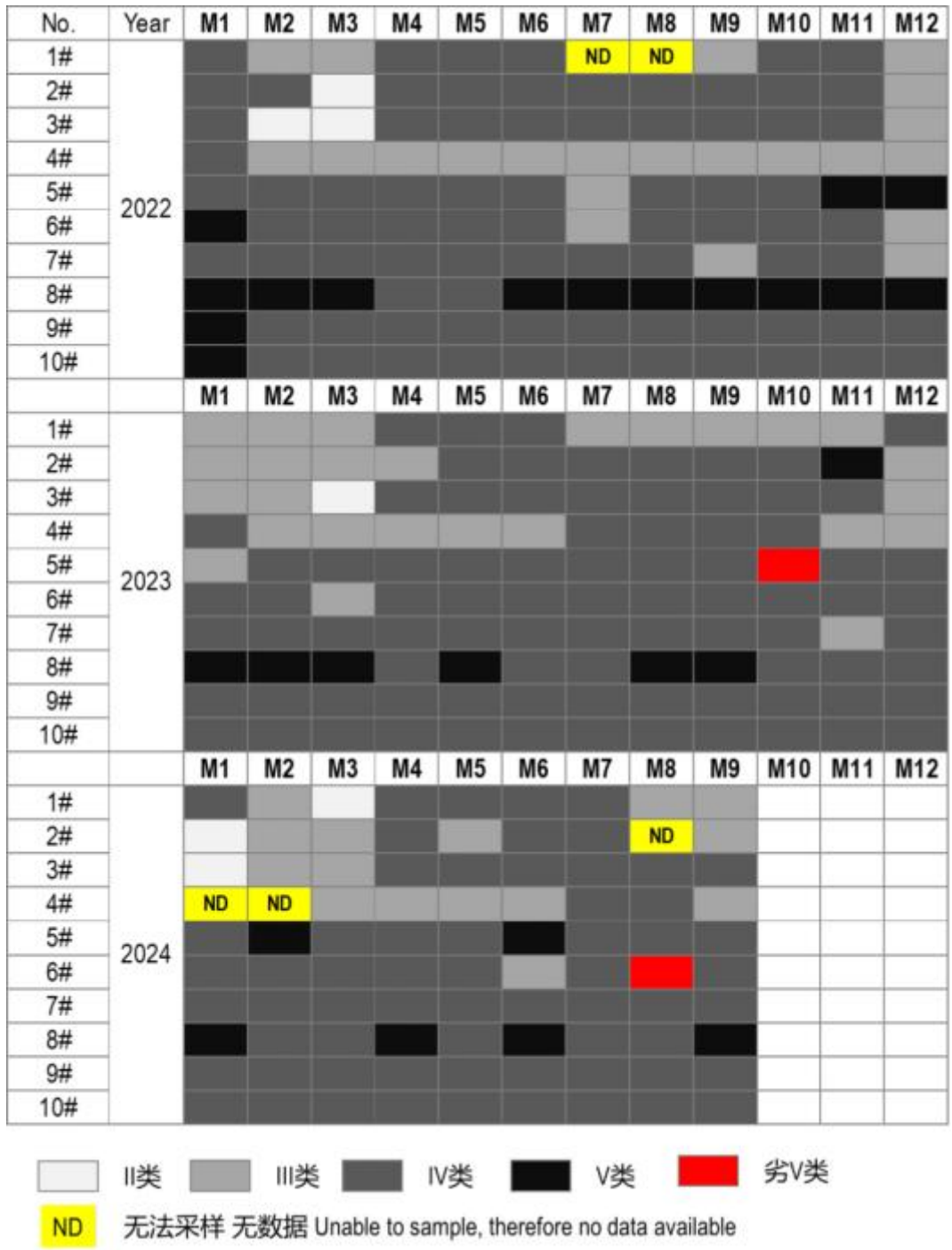
Table 5-11 River water quality monitoring points

Monitoring point number	River	Monitoring section
1#	Liaohe River	Jiutaizi
2#		Xing'an
3#		Shuguang Bridge
4#	Daliao River	Sancha River
5#	Raoyang River	Shenglitang
6#	Xiaoliuhe River	Zhabei Bridge
7#	Yitong River	Zhonghua Road and Bridge
8#	Pangxiegou River	Yugangzi
9#	Taiping River	Xinsheng Bridge
10#	Qingshui River	Qingshui River Gate

290. As can be seen from the chart, among the above monitoring points, from the upper reaches to the lower reaches of the Liaohe River, they are 1#, 2#, and 3# monitoring points. 6# represents the water quality of the Xiaoliuhe River merging into the Liaohe River, 7# represents the water quality of the Yitong River merging into the Liaohe River, 8# represents the water quality of the Crab Ditch merging into the Liaohe River, 10# represents the water quality of the Qingshui River merging into the Liaohe River, 5#

represents the water quality of the Raoyang River, and 4# represents the water quality of the Daliao River (Panjin section).

291. The water quality data of the above monitoring points from January 2022 to September 2024 are shown below.



Source: ESIA Consultant Nov 2024

Figure 5 -31 Statistics of surface water environment quality monitoring data in Panjin City

292. In general, most of the surface water in Panjin City is of Class IV quality. The main reasons are analyzed as follows. As can be seen from Section 5.1.4, Panjin City is located at the estuary and the end of the Liaohe River and the Daling River, and is affected by the cumulative impact of the water environment problems in the Liaohe River Basin. According to the "Panjin City's 14th Five-Year Plan for Ecological and Environmental Protection", during the "13th Five-Year Plan", the water environment

quality in Panjin City will be greatly affected by upstream water. It is very difficult to improve surface water to Class III and above standards.

293. From the perspective of space and water season, data from monitoring points 1#, 2#, and 3# show that the water quality of the main stream of the Liaohe River and the Daliaohe River is relatively good, and the water quality can reach Class III or even Class II water standards during the dry season (December-March). However, the water quality of the monitoring sections in the urban area is poor, especially at 8# Crab Ditch, where the water quality fluctuates between Class IV and Class V, especially in the dry season, when the water quality is more likely to reach Class V.

(2) Project site and surrounding areas

294. The main surface water involved in the project is the Panjin section of Liaohe River, Pangxigou, Yitong River, Qingshui River, etc. Regards as Project site and surrounding area. The current surface water quality monitoring evaluation cited the detection data of "Liaohe River Basin (Huntai River System) Mountains, Waters, Forests, Farmlands, Lakes, Grasslands and Deserts Integrated Protection and Restoration Project (Downstream Panjin Section)" from March 8 to 10, 2024 (dry season) and June 3, 2024 (flood season) (Report No.: Chenwu (Committee) 202405052) 16.

295. The four testing points of the environmental monitoring report (No.: Chenwu (Committee) 202405052) are shown in the figure. The sampling points are close to the project scope, and their detection data can better reflect the environmental quality of surface water within the project scope.

¹⁶<https://www.panjin.gov.cn:803/uploadfile/files/20240815085937242.pdf>



Source: ESIA Consultant Nov 2024

Figure 5-29 Surface water sampling locations

296. In terms of evaluation standards, the “Liaohu- 2 sampling point” implements the Class IV standard of the “Environmental Quality Standards for Surface Water (GB3838-2002)”. The “Pangxiogou sampling point”, “Nanhuan water system sampling point” and “Liaohu- 1 sampling point” implement the Class V standard requirements. The test data of each sampling point are shown in the following table.

Table 5-12 Hydrological monitoring information of surface water bodies

Chapter 5 Description of the Environmental and Social Economic Development

category	project	Sampling point			
		1# Pangxieyou	2# Nanhuan water system	3# Liaohe-1	4# Liaohe-2
Dry season (March 2024)					
Surface water	Water level (m)	1.9	1.8	0.6	7
	Water depth (m)	1.5	1.5	0.3	6
	Water temperature (°C)	2	1.7	1.9	2.2
	Flow rate	0.2	0.2	0.1	0.2
	flow	1.2	1.5	0.45	240
	Width (m)	7	3	15	200
Flood season (June 2024)					
Surface water	Water level (m)	2.5	2	1	9
	Water depth (m)	2.2	1.6	0.8	9
	Water temperature (°C)	23.2	23.8	24.2	23.6
	Flow rate	0.4	0.23	0.13	0.4
	flow	9.3	4.2	0.9	665
	Width (m)	15	11	19	210

Table 5-13 List of surface water quality Monitoring results

Test items	Sampling point				Unit
	1# Pangxieyou	2# Nanhuan water system	3# Liaohe-1	4# Liaohe-2	
Sampling time: 2024.3.8					
pH	7.3	7.2	7.1	7.3	
Ammonia nitrogen	1.09	1.41	0.394	0.654	mg/L
COD	25	27	29	17	mg/L
BOD ₅	4.3	3.7	1.8	4.3	mg/L
TP	0.29	0.29	0.12	0.29	mg/L
Petroleum	0.01	0.02	0.04	0.33	mg/L
DO	11.6	11.6	11	12.2	mg/L
Volatile phenol	<0.0003	<0.0003	0.0005	<0.0003	mg/L
Permanganate Index	8.89	8.64	5.18	3.22	mg/L
TN	8.09	4.43	2.12	4.06	mg/L
Sulfide	<0.01	<0.01	<0.01	<0.01	mg/L
arsenic	1.2	0.7	0.6	0.6	µg/L
mercury	<0.04	<0.04	<0.04	<0.04	µg/L
Anionic surfactants	<0.05	<0.05	<0.05	<0.05	mg/L
Water temperature	3	2.4	2.4	2.8	°C
Fecal coliform bacteria	4.9×10 ³	1.1×10 ⁴	7.9×10 ³	7.9×10 ³	MPN/L
Sampling time: 2024.3.9					
pH	7.3	7.2	7.2	7.4	
Ammonia nitrogen	1.18	1.28	0.48	0.721	mg/L
COD	19	27	25	19	mg/L
BOD ₅	2.1	2.8	1.1	1.8	mg/L
TP	0.28	0.29	0.14	0.29	mg/L

Test items	Sampling point				Unit
	1# Pangxiegou	2# Nanhuan water system	3# Liaohe-1	4# Liaohe-2	
Petroleum	0.05	0.01	0.05	0.37	mg/L
DO	11.6	11	10.7	12.5	mg/L
Volatile phenol	<0.0003	<0.0003	0.0019	<0.0003	mg/L
Permanganate Index	8.84	8.81	4.98	3	mg/L
TN	7.78	4.32	2.54	4.11	mg/L
Sulfide	<0.01	<0.01	<0.01	<0.01	mg/L
arsenic	1.3	0.7	0.6	0.6	µg/L
mercury	<0.04	<0.04	<0.04	<0.04	µg/L
Anionic surfactants	<0.05	<0.05	<0.05	<0.05	mg/L
Water temperature	3.2	2.4	2.4	2.6	°C
Fecal coliform bacteria	6.3×10^3	1.3×10^4	1.1×10^4	7.0×10^3	MPN/L
Sampling time: 2024.3.10					
pH	7.3	7.1	7.2	7.4	
Ammonia nitrogen	1.24	1.29	0.426	0.681	mg/L
COD	25	twenty one	25	twenty one	mg/L
BOD ₅	3.1	3	1.6	1.8	mg/L
TP	0.28	0.27	0.13	0.26	mg/L
Petroleum	0.03	0.04	0.07	0.31	mg/L
DO	11.5	11.2	10.2	11.6	mg/L
Volatile phenol	<0.0003	<0.0003	0.0008	<0.0003	mg/L
Permanganate Index	8.56	9.02	5.31	3.49	mg/L
TN	1.32	1.28	1.21	1.39	mg/L
Sulfide	<0.01	<0.01	<0.01	<0.01	mg/L
mercury	<0.04	<0.04	<0.04	<0.04	µg/L
Anionic surfactants	<0.05	<0.05	<0.05	<0.05	mg/L
Water temperature	2.8	2.2	2.4	2.6	°C
Fecal coliform bacteria	7.0×10^3	1.4×10^4	1.3×10^4	7.9×10^3	MPN/L

297. The single pollution index method of the "Technical Guidelines for Environmental Impact Assessment of Surface Water Environment" (H J2.3-2018) was used to evaluate the current status of surface water quality. The evaluation results show that the standard indexes of factors such as pH, ammonia nitrogen, COD, BOD₅, TP, petroleum, DO, volatile phenols, permanganate index, sulfide, arsenic, mercury, anionic surfactants, and fecal coliform bacteria at the above test points are all less than 1, and none of them exceed the standard.

298. However, the total nitrogen monitoring results at each sampling point exceeded the standard. The reason for the exceeding of the standard should be that: the project area belongs to the downstream of the Liaohe River and other rivers. According to the analysis of the national control section monitoring data, the total nitrogen concentration is higher as it goes downstream. The analysis should be that the downstream has accumulated the total nitrogen from the upstream, and the influx of total nitrogen from industrial and agricultural non-point sources such as cities and rural areas in the tributaries of the basin will also lead to an increase in the total nitrogen content downstream. In addition, the project area belongs to the paddy field planting area, and the use of nitrogen fertilizers by farmers will also cause the total nitrogen in the region to accumulate in the river soil. The discharge of domestic sewage from residents in the region will also lead to an increase in total nitrogen.

299. In summary, except for the TN, the monitoring results of other monitoring factors in the project area can meet the requirements of Class IV and Class V of the "Environmental Quality Standards for Surface Water (GB3838-2002)". The surface water quality in the project evaluation area is basically good.

5.4.4 Sediment environmental quality

300. In order to understand the current status of surface water environmental quality and the internal pollution of water bodies in the project area, this subsection evaluates the quality of the sediment of the surface water bodies in the evaluation area. The evaluation standards adopt the "Soil Environmental Quality Standard Agricultural Land Soil Pollution Risk Control Standard" (GB15618-2018) and the "Greening Planting Soil" (CJ/T340) Table 4 Greening Heavy Metal Content Standard Level II indicators.

301. The test results of the sediment status are based on the test data of the environmental impact assessment report of the "Liaohu River Basin (Huntai River System) Mountain, Water, Forest, Farmland, Lake, Grass and Sand Integrated Protection and Restoration Project (Downstream Panjin Section)". The test points are the same as the surface water sampling points. The sediment test results are as follows.

Table 5-14 Summary of sediment test results

Project	Unit	Sampling point				Limits	
		1#	2#	3#	4#	GB15618-2018	CJ/T340
pH	-	7.41	6.95	6.66	6.82	6.5<pH<7.5	pH>6.5
mercury	mg/kg	0.519	0.507	0.526	0.333	≤2.4	≤1.2
chromium	mg/kg	26	23	50	30	≤200	≤150
arsenic	mg/kg	15.9	19.7	16.9	18	≤30	≤30
lead	mg/kg	3.9	2.9	2.7	4.2	≤120	≤200
nickel	mg/kg	35	27	45	28	≤100	≤50
cadmium	mg/kg	0.22	0.26	0.29	0.25	≤0.3	≤0.8
copper	mg/kg	46	47	74	61	≤100	≤150
Zinc	mg/kg	55	29	41	43	≤250	≤250
Total amount of 666	μg /kg	ND	ND	ND	ND	0.1	-
Total amount of DDT	μg /kg	ND	ND	ND	ND	0.1	-
Benzo[a]pyrene	μg /kg	ND	ND	ND	ND	0.55	-

302. The test results show that the sediment meets the standard requirements of Level II indicators in the "Soil Environmental Quality Standard Agricultural Land Soil Pollution Risk Control Standard" (GB15618-2018) and the "Greening Planting Soil" (CJ/T340) Table 4 Greening Heavy Metal Content Standard.

5.4.5 Groundwater environmental quality

303. The groundwater quality complies with Class III standards as per the "Groundwater Quality Standards" (GB/T14848-2017).

304. This groundwater quality monitoring and evaluation uses the test results of Liaoning Chenwu Environmental Testing Technology Service Co., Ltd. in March 2024. The test points are shown in the figure.



Source: ESIA Consultant Nov 2024

Figure 5-30 Groundwater sampling location map

305. Groundwater testing indicators include: pH, total hardness, total dissolved solids, permanganate index, sulfate, ammonia nitrogen, petroleum, nitrate, nitrite, fluoride, chloride, cyanide, volatile phenols, mercury, arsenic, chromium (hexavalent), iron, manganese, Escherichia coli, K^+ , Na^+ , Ca^{2+} , Mg^{2+} , CO_3^{2-} , HCO_3^- , Cl^- , SO_4^{2-} , a total of 27 items.

Table 5-15 of groundwater quality test results

Project	unit	Groundwater sampling points		
		1#	2#	3#
Chroma	Spend	5	5	5
Smell and taste	—	none	none	none
pH	-	7.4	7.6	7.2
Total hardness	mg/L	172	70	108
Total dissolved solids	mg/L	240	356	676
Sodium	mg/L	25.3	100	194
Iron	mg/L	<0.03	0.07	<0.03
Manganese	mg/L	<0.01	<0.01	0.08
Volatile phenol	mg/L	<0.0003	<0.0003	0.0004
Permanganate index (in O2)	mg/L	1.02	0.91	2.79
Ammonia nitrogen	mg/L	0.284	0.335	0.094
Sulfide	mg/L	0.005	<0.003	<0.003
Nitrite (as N)	mg/L	0.022	0.024	0.888
Nitrate (as N)	mg/L	2.19	2.17	1.87
Cyanide	mg/L	0.004	<0.002	<0.002
Fluoride	mg/L	0.11	0.205	0.65
Mercury	µg /L	<0.04	<0.04	<0.04
Arsenic	µg /L	1.1	0.5	0.8
Cadmium	µg /L	<1	<1	<1
Chromium (hexavalent)	mg/L	<0.004	0.005	0.005
Lead	µg /L	<10	<10	<10
Sulfate	mg/L	<0.018	<0.018	159
Chloride	mg/L	21.7	21.8	177
Petroleum	mg/L	0.04	0.01	0.04
Total coliforms *	MPN/100mL	ND	ND	ND
Total colony count *	CFU/mL	85	91	73

Table 5-16 List of groundwater ion detection results

project	unit	3 #	6#	9#
K+	mg/L	14.8	14.6	49
Na+	mg/L	25.3	100	194
Ca ²⁺	mg/L	5.29	4.95	3.43
Mg ²⁺	mg/L	37	14.6	22.4
CO ₃ ²⁻	mg/L	<5	<5	<5
HCO ₃ ⁻	mg/L	240	344	184
Cl ⁻	mg/L	21.7	21.8	177
SO ₄ ²⁻	mg/L	<0.018	<0.018	159
Water chemistry type	-	HCO ₃ -Mg ; HCO ₃ -Na ; Cl ⁻ -Na type	HCO ₃ -Na type	HCO ₃ -Na ; HCO ₃ -Ka type

306. The single factor index method was used to evaluate the current status of groundwater environmental quality. The evaluation results showed that the groundwater met the Class III water quality standards in the "Groundwater Quality Standard" (GB/T14848-2017), and the petroleum met the standard requirements of the "National Drinking Water Quality Standard" (GB5749-2022).

5.4.6 Soil environmental quality

307. This section will analyze and understand the soil environmental quality at (1) the Panjin city level

and (2) the project site and its surrounding areas.

(1) Panjin City Level

308. Panjin is an important petrochemical base in China. Relying on the Liaohe Oilfield, it has formed a relatively complete industrial chain, covering the production and processing of many products such as gasoline and diesel. Panjin City has planned and built a number of petrochemical industrial parks to concentrate on the refining and deep processing of petrochemical products. The historical development of industrial industries has inevitably brought about soil pollution problems, such as "Panjin Northern Asphalt Fuel Co., Ltd. Old Factory Area Polluted Land" and "Panjin Liaobin Coastal Economic and Technological Development Zone Soil Pollution".

309. Based on the above problems, Panjin City (i) carried out land surveys for key industry enterprises, completed the collection of land survey information and spatial information map reporting for key industry enterprises in the city, and carried out soil risk screening and rectification work. (ii) Established a soil pollution risk control and remediation list system for construction land, and included the list of suspected polluted plots and the list of polluted plots into the national soil environmental management system for polluted plots. (iii) Issued a soil pollution prevention and control work plan, published a list of key soil environmental supervision enterprises, signed soil pollution prevention and control target responsibility letters with each key soil environmental supervision enterprise, and urged the enterprises to fulfill their soil pollution prevention and control responsibilities. (iv) Implemented a number of soil remediation projects including: "Panjin Northern Asphalt Co., Ltd. Whole Plant Sewage System Renovation Project" and "Panjin Liaobin Coastal Economic and Technological Development Zone Soil Remediation Project".

310. Through the collection of preliminary data, the overall soil environmental quality in Panjin City is currently good. For cultivated land, Panjin City sampled, monitored and analyzed the soil environmental quality of 1,990 agricultural land points. At present, the existing cultivated land area of 2.4 million mu in Panjin City is all priority protected cultivated land, and there is no safe utilization or strictly controlled cultivated land. For construction land, Panjin City has carried out a detailed land survey, formulated a governance and restoration plan for polluted plots, and carried out regular monitoring of conventional plots. Taking the "Taiping Street Yongjun Village Soil Remediation Demonstration Project" as an example, this project is for the remediation of soil contaminated by oil extraction, with a total investment of 120 million yuan and a remediation area of about 2,000 mu. The project completed the in-situ remediation of lightly and moderately contaminated soils and the ex-situ remediation of heavily contaminated soils using thermal desorption technology.

(2) Project site and surrounding areas

311. According to Appendix A of the Guidelines for Soil Environmental Impact Assessment, this project belongs to Class III water conservancy projects. The possible soil environmental impact type is ecological impact. This soil quality monitoring and evaluation refers to the test results of the "Liaohe River Basin (Huntai River System) Mountain, Water, Forest, Farmland, Lake, Grass and Sand Integrated Protection and Restoration Project (Downstream Panjin Section)". The test points are shown in the figure.



Source: ESIA Consultant Nov 2024

Figure 5-31 Soil sampling location map

312. Sampling points 1# and 3# are agricultural lands, and sampling and analysis are carried out in accordance with the relevant regulations and standards such as the Soil Environmental Quality Agricultural Land Soil Pollution Risk Control Standards to reflect the soil environmental quality of agricultural land near the project site.

313. The analysis of sampling point 2# was conducted in accordance with the relevant national regulations and standards such as the "Technical Guidelines for Investigation of Soil Pollution Status in Construction Land" (HJ25.1-2019), "Technical Guidelines for Risk Control and Remediation Monitoring of Soil Pollution in Construction Land" (HJ25.2-2019), and "Soil Environmental Quality Construction Land Soil Pollution Risk Control Standards" to reflect the soil environmental quality of the construction land near the project site.

314. The test results of the soil sampling points are shown in the following table.

Table 5- 17 List of soil test results of agricultural land near the project

No.	Test items	unit	Point	
			1#	3#
1	pH	Dimensionless	7.24	7.14
2	cadmium	mg/kg	0.16	0.28
3	mercury	mg/kg	0.186	0.302
4	arsenic	mg/kg	17.6	17.2
5	lead	mg/kg	30	41
6	Total Chromium	mg/kg	134	113
7	copper	mg/kg	41	25
8	nickel	mg/kg	93	83
9	Zinc	mg/kg	65	56
10	Petroleum hydrocarbons (C10-C40)	mg/kg	83	151

Table 5- 18 List of inspection results of construction land near the project

No.	Test items	unit	Point
			2#
1	Carbon tetrachloride	mg/kg	ND
2	Chloroform	mg/kg	ND
3	Methyl chloride	µg /kg	ND
4	1,1- dichloroethane	mg/kg	ND
5	1,2- dichloroethane	mg/kg	ND
6	Benzene	mg/kg	ND
7	1,1 -dichloroethylene	mg/kg	ND
8	Cis -1,2- dichloroethylene	mg/kg	ND
9	Trans -1,2- dichloroethylene	mg/kg	ND
10	Dichloromethane	mg/kg	ND
11	1,2- dichloropropane	mg/kg	ND
12	1,1,1,2- tetrachloroethane	mg/kg	ND
13	1,1,2,2- tetrachloroethane	mg/kg	ND
14	Tetrachloroethylene	mg/kg	ND
15	1,1,1- trichloroethane	mg/kg	ND
16	1,1,2- trichloroethane	mg/kg	ND
17	Trichloroethylene	mg/kg	ND
18	1,2,3- trichloropropane	mg/kg	ND
19	Vinyl chloride	mg/kg	ND
20	Chlorobenzene	mg/kg	ND
21	1,2- dichlorobenzene	mg/kg	ND
22	1,4 -dichlorobenzene	mg/kg	ND
23	Ethylbenzene	mg/kg	ND
24	O-Xylene	mg/kg	ND
25	Styrene	mg/kg	ND

No.	Test items	unit	Point
			2#
26	Toluene	mg/kg	ND
27	M-Xylene + p-Xylene	mg/kg	ND
28	Nitrobenzene	mg/kg	ND
29	Aniline	mg/kg	ND
30	2- chlorophenol	mg/kg	ND
31	Benz [a] anthracene	mg/kg	ND
32	Benzo [a] pyrene	mg/kg	ND
33	Benzo [b] fluoranthene	mg/kg	ND
34	Benzo [k] fluoranthene	mg/kg	ND
35	Bleak	mg/kg	ND
36	Dibenzo [a,h] anthracene	mg/kg	ND
37	Indeno [1,2,3-cd] pyrene	mg/kg	ND
38	Naphthalene	mg/kg	ND
39	Petroleum hydrocarbons (C10-C40)	mg/kg	13
40	Cadmium	mg/kg	0.45
41	Mercury	mg/kg	0.215
42	Arsenic	mg/kg	12.8
43	Lead	mg/kg	<10
44	Total chromium	mg/kg	5.2
45	Copper	mg/kg	86
46	Nickel	mg/kg	1.3
47	pH	Dimensionless	7.28

315. The single factor standard index method was used to evaluate the current status of soil environmental quality in the project area. According to the analysis results, the monitoring indicators of monitoring points 1# and 3# are lower than the agricultural land soil pollution risk screening value (basic project) requirements of the "Soil Environmental Quality Agricultural Land Soil Pollution Risk Control Standard (Trial)" (GB15618-2018), and the 2# monitoring point is also lower than the risk screening value of the second category of land in the "Soil Environmental Quality Construction Land Soil Pollution Risk Control Standard (Trial)" (GB 36600-2018), indicating that the current soil environmental quality in the project area is good and the soil pollution risk is low.

5.5 Socioeconomic baseline

5.5.1 population status

(1) population structure

316. According to the national economic and social development statistical report of each district, by the end of 2023, Panjin City has a total registered residence households of 478,000, 1,285,000 people, including 634,900 men and 650,100 women. The agricultural population is 289,000, accounting for 22.5%; The non-agricultural population is 996,000, accounting for 77.5%. The population density is 335 people per square kilometer.

317. Shuangtaizi District has a total registered residence population of 187,000, including 94,000 men, accounting for 50.27%; 93,000 women, accounting for 49.73%. The agricultural population is 8,800, accounting for 4.71%; The non-agricultural population is 178,200, accounting for 95.29%. The population density is 1,654 people per square kilometer.

318. Xinglongtai District has a total registered residence population of 449,000, of which 222,000 are male, accounting for 49.44%; 227,000 women, accounting for 50.56%. The agricultural population is 20,700, accounting for 4.71%; The non-agricultural population is 178,200, accounting for 95.29%.

The population density is 533 people per square kilometer.

319. Dawa District has a total registered residence population of 142,000, including 191,000 males, accounting for 49.48%; 195,000 women, accounting for 50.52%. The agricultural population is 110,600, accounting for 28.65%; The non-agricultural population is 275,400, accounting for 71.35%. The population density is 310 people per square kilometer.

Table 5-19 List of Population in Project Counties and Districts Unit (10000) (2023)

Demographic indicators	Panjin City	Shuangtaizi District	Xinglongtai District	Dawa District
Total number of households at the end of the year (10000 households)	47.8	5.3	17.6	14.2
Total population at the end of the year (10000 people)	128.5	18.7	44.9	38.6
Male population (10000 people)	63.49	9.4	22.2	19.1
Female population (10000 people)	65.01	9.3	22.7	19.5
Population density (people/km ²)	335	1654	533	310
Agricultural population (10000 people)	28.9	0.88	2.07	11.06
Urban population (10000 people)	99.6	17.82	42.83	27.54

Source: Population data is sourced from various national economic and social development statistical reports.

(2) Population of Ethnic Minorities in the Project Area

320. The beneficiary area of this project involves 17 townships/subdistricts in Shuangtaizi District, Xinglongtai District and Dawa District of Panjin City. The direct beneficiary population along the project sites in the three districts is about 879,914 people, including 731 ethnic minorities.

321. Among them, the ethnic minorities are mainly the Korean ethnic group (99.79% of the minority population in the project area) and the Mongolian ethnic group (0.003% of the total population). There is no concentrated minority population in the project area. The minority population is small and scattered, and most of them are Korean and Mongolian people who enter the project area due to marriage and work transfer.

5.5.2 Socioeconomic baseline

322. As of the end of 2023, the land area of Panjin City is 5399.2 km², with a per capita disposable income of 46,485 yuan for urban residents and 23,234 yuan for rural residents. The per capita GDP is 100,347 yuan. The total regional GDP of the city was 139.43 billion yuan, a decrease of 6.3% from the previous year. Among them, the added value of the primary industry was 10.99 billion yuan, a decrease of 6.3%; The added value of the secondary industry was 76.5 billion yuan, a decrease of 12.6%; The added value of the tertiary industry was 51.94 billion yuan, an increase of 1.8%. The structure of the three industries is 7.9:54.8:37.3.

323. **The number of employees and composition of non-private units in urban areas of the city by industry.** The total number of employees in the three major industries is 283,800, of which 49,500 are employed in the primary industry, accounting for 17.4% of the total employment; 127,800 are employed in the secondary industry, accounting for 45.0%; and 106,500 are employed in the tertiary industry, accounting for 37.5%.

324. **Basic situation of Xinglong Farm.** Panjin Xinglong Farm Co., Ltd. has been established in May 2018. It was formerly the state-owned Xinglong Farm, which was founded in 1987. It currently has 10 party branches and 135 party members. It now has 8 subsidiaries, 1 agricultural water conservancy service station, and 7,283 agricultural workers; the administrative area within the jurisdiction covers an area of 5,368 hectares, the agricultural land covers an area of 3,507.7 hectares, 24 natural villages, 8,405 households, and the total asset value has reached 290 million. With the help of major national strategies and relying on its own high-quality resources, Xinglong Farm has now developed into a large-scale modern agricultural state-owned enterprise integrating green rice planting and processing, river crab farming, fish and vegetable symbiosis, flower nursery, and leisure science popularization agriculture. It plays a vital role in the agricultural revitalization of the eastern part of Xinglongtai District,

Panjin City.

325. As a state-owned farm, Xinglong Farm is centered on state ownership. The land and assets are owned by the state and are uniformly managed by the farm enterprise. Through market-oriented operations, it realizes asset preservation and appreciation, while promoting the development of modern agriculture. The livelihood model of farmers relies on the agricultural resources, technical support and industrial chain services provided by the farm. The Farm mainly obtains income through participating in diversified agricultural activities such as green rice planting, river crab farming, and fish and vegetable symbiosis, forming a livelihood feature of increasing income and getting rich by relying on the state-owned farm platform, which has played an important role in the revitalization of regional agriculture and the improvement of farmers' living standards.

5.5.3 Income status

326. This project involves Xinglongtai District, Shuangtaizi District, and Dawa District in Panjin City. From the perspective of socio-economic development, among the three project areas, Dawa District has the largest area, followed by Xinglongtai District and Shuangtaizi District; In terms of per capita disposable income of urban residents, Xinglongtai District has the highest and Dawa District has the lowest; In terms of per capita disposable income of rural residents, Xinglongtai District has the highest and Dawa District has the lowest; In terms of total fiscal revenue, Xinglongtai District and Dawa District have the highest, while Shuangtaizi District has the lowest.

Table 5-20 List of Main Indicators of Social and Economic Development in the Project Impact Area (2023)

Province, City, County	Land area (km ²)	Per capita disposable income of urban residents (yuan)	Per capita disposable income of rural residents (yuan)	Per capita GDP (yuan)	Total fiscal revenue (in billions of yuan)
Panjin City	5399.2	46485	23234	100347	121.36
Xinglongtai District	1068.6	56950	27276	87995	8.7
Shuangtaizi District	138.3	37095	24654	81550	3.7
Dawa District	2319.7	30652	23572	47176	8.7

Data source: Statistical yearbooks or national economic and social development statistical reports collected by the environmental and social impact assessment survey team from various districts.

5.5.4 Education

327. There are 29,395 children in kindergartens throughout the year. Ordinary primary schools enrolled 12,496 students, with 69,664 students and 10,373 graduates. Junior high schools enrolled 11,670 students, with 35,579 students and 12,535 graduates. Ordinary high schools enrolled 8,040 students, with 23,930 students and 7,480 graduates. Secondary vocational schools enrolled 4,138 students, with 13,422 students and 4,061 graduates. Higher vocational schools enrolled 3,690 students, with 10,245 students and 2,574 graduates¹⁷.

5.6 Material and cultural resources

328. There are no known cultural relics or material cultural resources that need to be protected within the scope of this project based on information provided by the Panjin PMO, municipal Bureau of Culture, and municipal Bureau of Ethnic and Religious Affairs¹⁸.

5.7 Environmental and Social Protection Target

¹⁷ Panjin Municipal Government (2023). Statistical Report on the 2023 National Economic and Social Development.

¹⁸ Source: Panjin PMO, Panjin municipal Bureau of Culture, and Panjin municipal Bureau of Ethnic and Religious Affairs

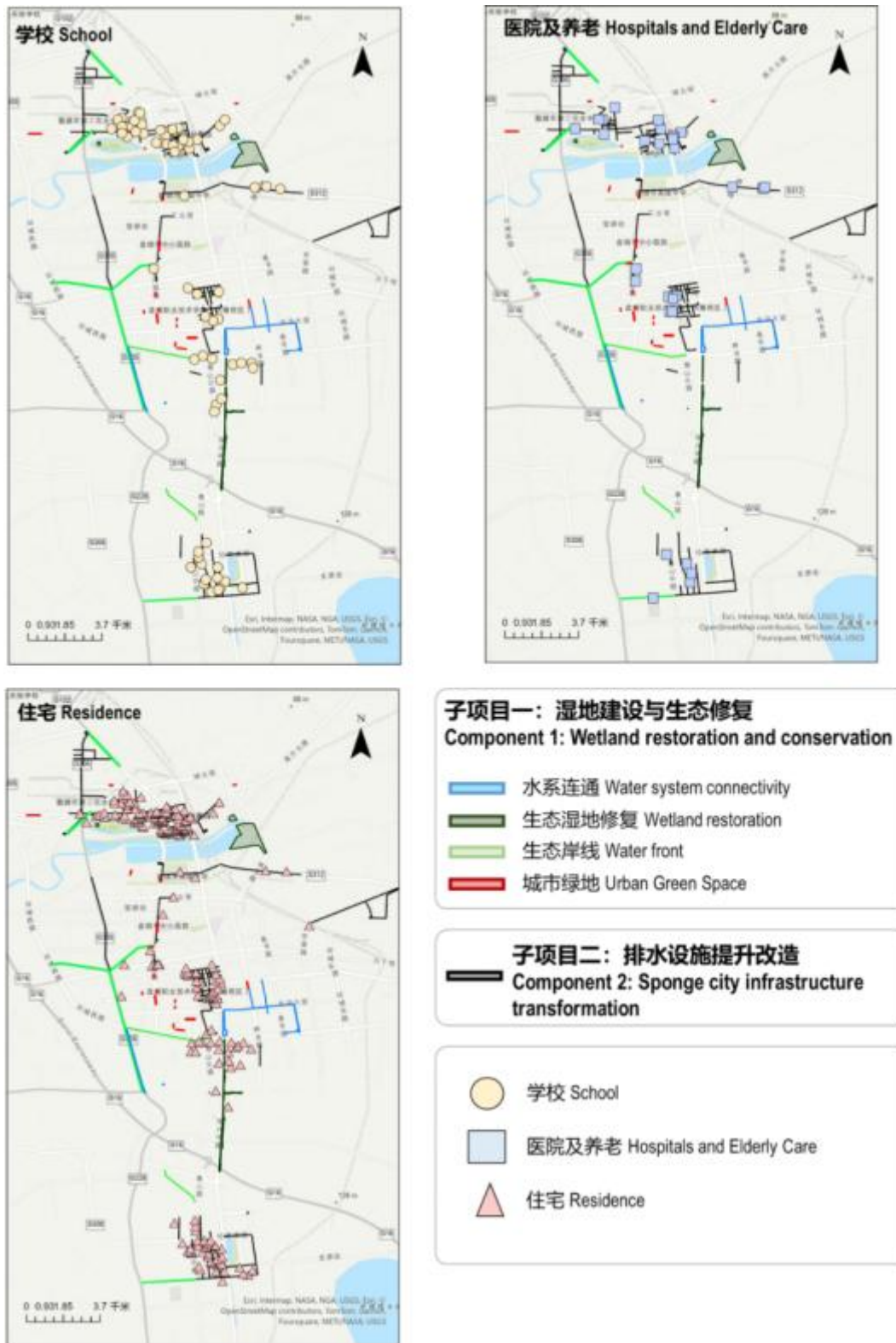
329. The environmental and social protection targets referred to in this subsection are sensitive groups that are affected by the environmental and social impacts of project construction and operation, including schools, hospitals, elderly care facilities, residences and other targets that require special protection.

330. The construction content of this project is relatively diverse and covers a wide range. A single target screening principle cannot identify important environmental and social protection targets. Therefore, this subsection will carry out social and environmental protection target identification based on the impact of the project's construction and operation stages.

5.7.1 Protection target during construction period

331. As can be seen from Chapter 3, the projects are distributed in three districts of Panjin City, all in the central urban area. According to the environmental impact identification during the construction period in Section 6.1, all kinds of project activities will have short-term impacts on the surrounding areas such as main noise and dust during the construction period. The distribution of schools, hospitals, nursing homes, and residential sites within 200m around the project is shown in the figure below¹⁹. According to statistics, there are currently about 74 schools (including kindergartens), 28 hospitals (including nursing homes), and 211 residential buildings within 200m around the project. The scope of the short-term impact of the project is large and involves many sensitive groups. In addition, based on the ecological environment baseline analysis in Section 5.2, the project construction is located in the urban area and there are mostly resident birds such as sparrows in the urban area, which is far away from the protected area. The impact on key birds during the project construction is very small, and key birds such as red-crowned cranes are not the ecological environment protection targets of this project.

¹⁹ Refer to the identification standard of environmental protection targets in the Technical Guide for the Preparation of Environmental Impact Report Form of Construction Projects and the assessment scope in the Technical Guidelines for Environmental Impact Assessment Acoustic Environment

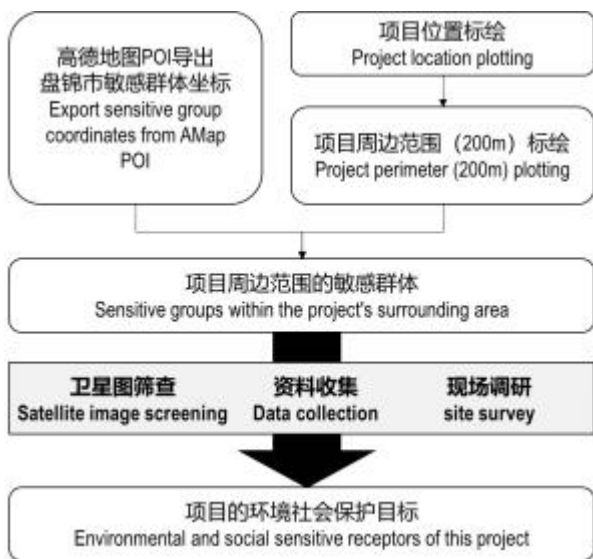


Source: ESIA Consultant Nov 2024

Figure 5 - 35 Distribution of schools, hospitals, nursing homes and residential areas within 200m of the project Environmental protection target range

332. In order to accurately identify the key environmental and social protection targets affected by the project, schools, hospitals, nursing homes and residences within 200m of the project were further screened according to the distance of the project, building functions and actual on-site investigation conditions, and the environmental protection targets during the construction period of this project were

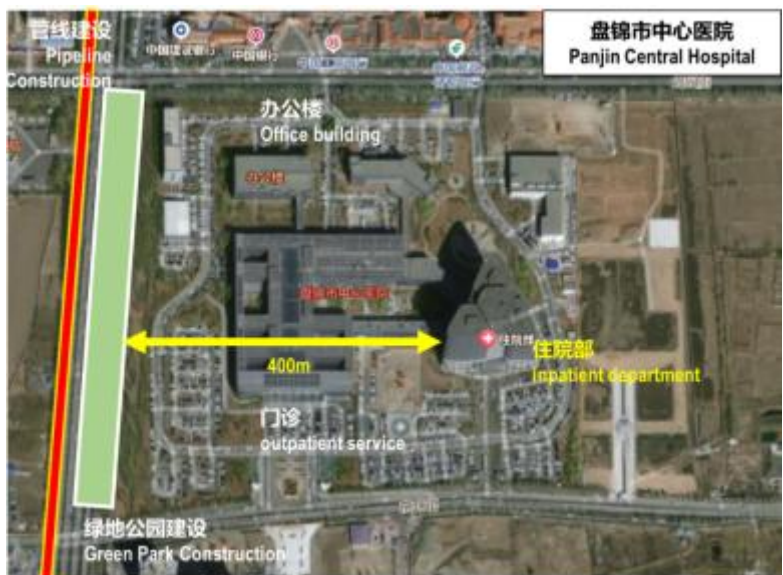
selected. The screening plan is as follows:



Source: ESIA Consultant Nov 2024

Figure 5 -36 Environmental and Social protection target screening method for this project

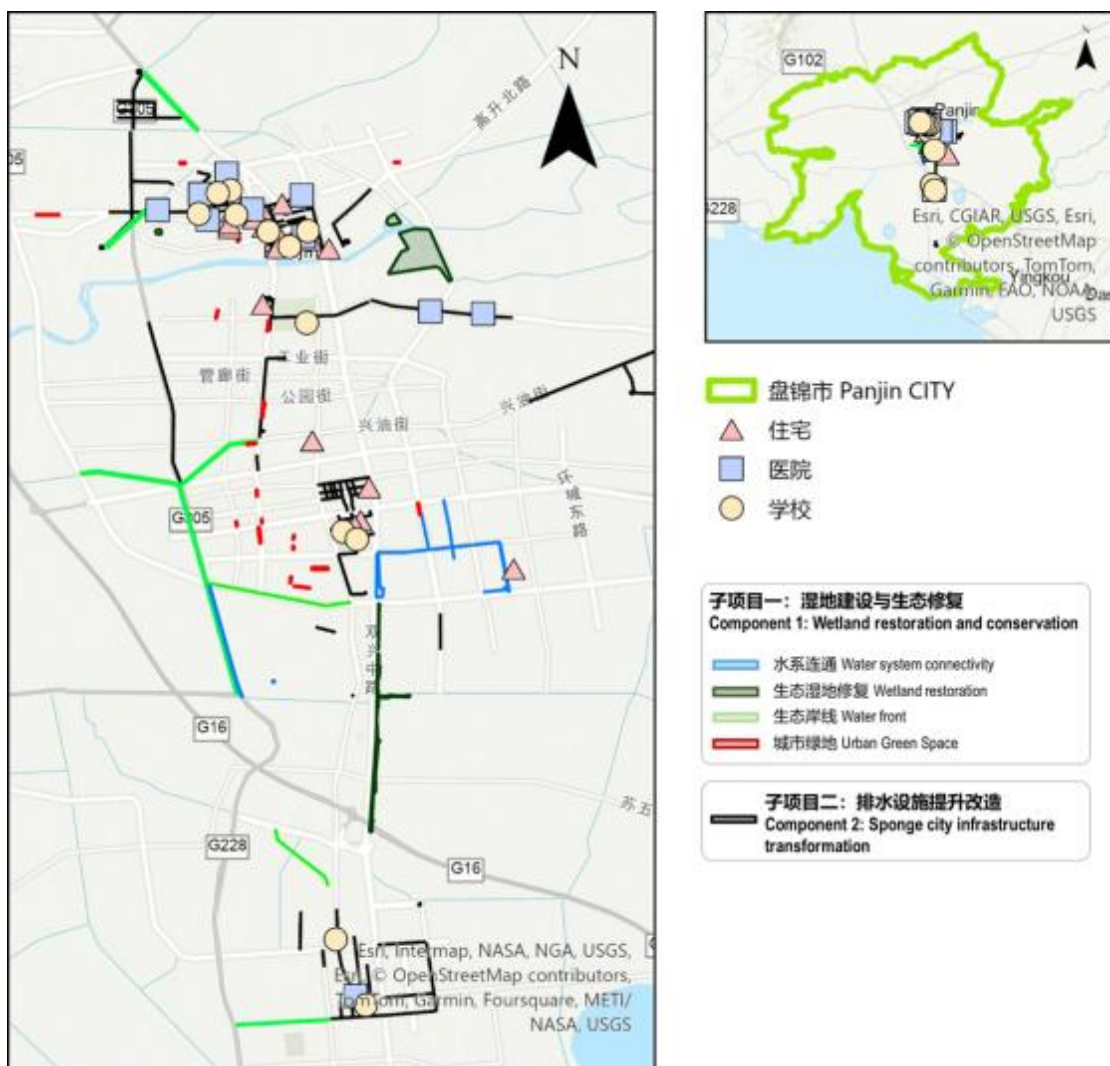
333. Taking the "Liaohu Middle Road Pump Station Area Rainwater and Sewage Diversion Reconstruction Project" and the "Urban Ecological Green Island Construction Project (Xinglongtai District) Project" as examples, after GIS geographic registration of the network map, Panjin Central Hospital is relatively close to the project. However, according to on-site investigations, it was found that the buildings closer to the project are outpatient clinics and office buildings, and the inpatient department, which needs to be kept particularly quiet, is more than 400m away from the project. After attenuation over this distance, the short-term environmental impact caused by the construction is relatively small. Therefore, Panjin Central Hospital is not a special environmental and social protection target of this project.



Source: ESIA Consultant Nov 2024

Figure 5 -37 Schematic diagram of environmental protection target screening for this project (taking Panjin Central Hospital as an example)

334. The graphic and list of environmental and social protection targets screened out by this project are as follows:



Source: ESIA Consultant Nov 2024

Figure 5 -38 Schematic diagram of the location of environmental and social protection targets during the construction period of this project

Table 5-21 ES protection goals during the construction period

No.	Environmental and social protection target name	longitude	latitude	Minimum distance (m)	Remark
1	Panjin Central Hospital Liaohe Branch	122.0163	41.19153	59	General Hospital
2	Panshan County People's Hospital	122.0409	41.19171	20	General Hospital
3	Panshan Health Association Hospital	122.0538	41.19539	51	General Hospital
4	Panjin Railway Thirteenth Bureau Hospital	122.0293	41.18903	63	General Hospital
5	Panjin Jingpu Hospital	122.0342	41.20103	37	General Hospital
6	Panjin Jinhe Hospital	122.101	41.16449	54	General Hospital
7	Panjin City Hospital	122.0543	41.18474	33	General Hospital
8	Liaoyou Petrochemical Hospital	122.0872	41.16514	37	General Hospital
9	Intermediate People's Court Residential	122.0676	41.10877	15	Residential

Chapter 5 Description of the Environmental and Social Economic Development

	Community				area
10	Sunny Community	122.0545	41.18586	17	Residential area
11	Emerging Residential Area	122.0414	41.18973	18	Residential area
12	Sports Committee North Building	122.0691	41.11103	20	Residential area
13	District Bureau Chengjiao Township Family Building	122.0357	41.19142	15	Residential area
14	Mingyuewan Community	122.0487	41.19353	30	Residential area
15	No.180 Liaohe North Road	122.0439	41.18745	20	Residential area
16	Limin Community	122.0484	41.18435	31	Residential area
17	Junminyuan Community	122.0676	41.10966	24	Residential area
18	Huaxing Community	122.0376	41.19165	27	Residential area
19	Lakeside Four Seasons City	122.035	41.1872	21	Residential area
20	No.169 Hongqi Sub-district	122.0432	41.1921	24	Residential area
21	No.21, Fanrong Road	122.053	41.18564	22	Residential area
22	Dongfeng Street Community	122.0561	41.18407	20	Residential area
23	Beili Community	122.035	41.18836	33	Residential area
24	Suning Rongyue Community	122.0713	41.1196	28	Residential area
25	City High School Community	122.0475	41.18202	60	Residential area
26	First Complete Secondary School	122.0645	41.10782	85	Middle School
27	Dawa District High School	122.0627	41.00153	50	Middle School
28	Panjin City High School	122.0551	41.16212	68	Middle School
29	No.2 Senior High School	122.0506	41.182	83	Middle School
30	Dormitory area of Chinese medicine hospital	122.0474	41.18642	63	dormitory
31	Changzheng Primary School	122.0353	41.19661	88	primary school
32	Yuhong Primary School	122.0554	41.18605	22	primary school
33	Weijia Primary School	122.0319	41.19596	12	primary school
34	Experimental Primary School	122.0451	41.18597	71	primary school
35	Liaohe Primary School	122.0367	41.19032	77	primary school
36	Jiuhua Primary School	122.0269	41.1905	62	primary school
37	Hexiang Primary School	122.0681	41.10571	75	primary school
38	Dawa No.3 Primary School and No.2 Junior High School	122.0705	40.98432	34	primary school
39	Chengcai Nursing Home	122.0273	41.19574	86	Vacation retirement
40	Dawa District People's Hospital	122.0678	40.98676	20	General Hospital
41	Fairview Garden	122.0436	41.16732	86	Residential area
42	Pioneer Community	122.0565	41.13175	25	Residential area
43	Xianghe Bay	122.0608	41.18183	43	Residential area
44	Ershili Village	122.109	41.09834	173	village

5.7.2 Protection goals during operation period

335. According to the environmental impact identification during the operation period in Section 6.1, the newly built and expanded pump stations and newly built roads in the project activities will have long-term

impacts on the surrounding areas such as noise, dust, and odor during the operation period. Other pipeline, wetland landscape and park projects will not have negative impacts during the operation period.

336. Based on actual investigation and data collection, the environmental protection goals during the operation period are determined as follows:

(1) Xianfeng Community

337. Xianfeng Community may be affected by the operation period of the rebuilt “Zhuanglin Pumping Station”. The northernmost row of residential buildings in Xianfeng Community is located about 25m southwest of the “Zhuanglin Pumping Station”.



Source: ESIA Consultant Nov 2024

Figure 5 -39 Environmental and social protection goals for the project during operation period - Xianfeng Community

(2) Jinxiuyuan Community

338. Jinxiuyuan Community is 86m away from the newly built "Liaozhong Road Pumping Station" and is located on the southwest side of the pumping station. During operation, it may be affected by noise, odor, etc. from the pumping station.



Figure 5 -40 Environmental and social protection targets for the project during operation period - Jinxiuyuan Community

(3) Xianghewan Community

339. Xianghewan Community may be affected by the operation period of the rebuilt “Southward Pump Station”. The easternmost row of residential buildings in Xianghewan Community is located about 43m west of the pump station.



Source: ESIA Consultant Nov 2024

Figure 5 - 41 Environmental and social protection goals for the project during operation period - Xianghewan Community

340. After field investigation, there are no residential houses, hospitals, schools or other sensitive targets that need to be protected around the other newly built and rebuilt pumping stations (Jinpanhe Street Pumping Station, Donghua Road Pumping Station, Liaohe South Road Pumping Station, Chunjiang Street Pumping Station and Dafengche Pumping Station).

341. For the two new municipal roads built by the project, there are currently residents of state-owned farms on the new Petrochemical Road (the rainwater pump station and supporting projects in the southern section of Petrochemical Road). The above residents will be resettled as the project is built. After the project is put into operation, there will be no residential buildings, hospitals, schools or other sensitive targets that need to be protected near the project site.

342. The situation of the newly built Zhanqian Street (Gaojia Pump Station Reconstruction and Rainwater and Sewage Diversion Project) is similar to the above. The residents on the land will be relocated before construction, so there are no residential buildings, hospitals, schools or other sensitive targets that need to be protected near the project site during the operation period.

6 Environmental Impact and Risk Analysis and Mitigation Measures

343. This chapter focuses on analyzing the environmental impact of the project from two aspects: (i) analyzing the environmental benefits generated by the project from the regional and strategic levels, focusing on the contribution of the project to the climate resilience, biodiversity and the ecological environment of the downstream Liaohe Estuary wetland in Panjin; (ii) analyzing the specific environmental impact of construction and operation from the perspective of project engineering and put forward corresponding mitigation measures.

6.1 Overall Impact of the Project on the Regional Environment

344. The overall impact of this project on the regional environment is mainly reflected in three aspects: (i) improving the city's climate resilience to rainstorm and flood disasters; (ii) enhancing urban biodiversity; and (iii) improving ecological environment of the Liaohe Estuary wetland, the downstream of the project.

6.1.1 Improving urban climate resilience to extreme precipitation and floods

345. Panjin City is located at the estuary of the Liaohe River and the Daling River, at the end of the water system. Flood control is affected by its precipitation, upstream water and tidal support. The urban built-up area is flat, and rainwater is collected in canals such as the Yitong River and flows into the Liaohe River, which is the only external river for urban drainage. Due to the above factors, Panjin City is prone to flood disasters when encountering extreme weather such as heavy rain. According to historical records, Panjin has experienced major flood disasters in 1991, 1995, 1997, 2019, 2022 and 2024. The urban waterlogging in 2024 is shown in the figure below.

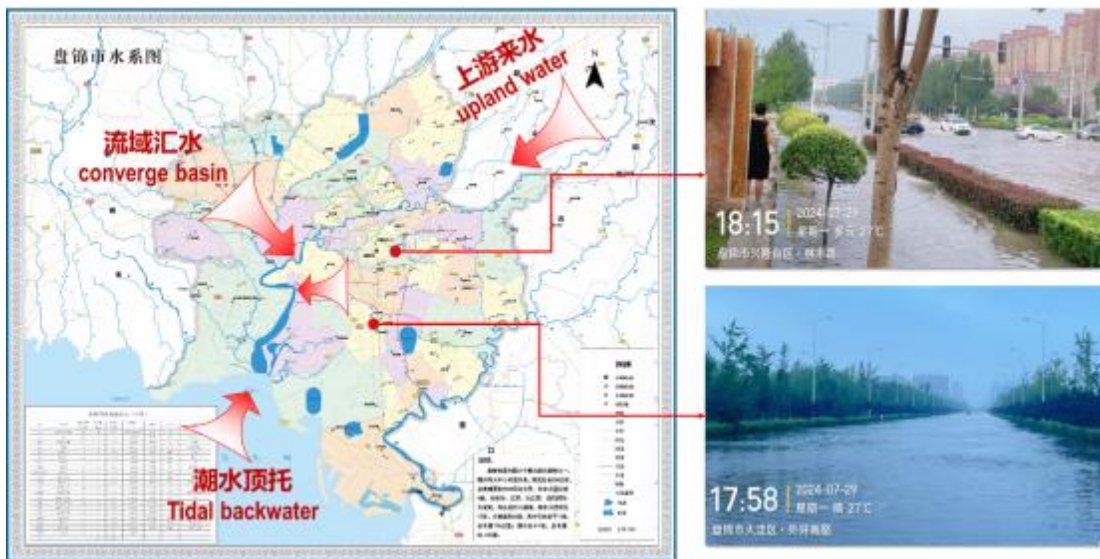


Figure 6-1 Schematic diagram of the causes of floods in Panjin and photos of urban waterlogging in 2024

346. According to the forecast and analysis of climate change and its impact on runoff in the Liaohe River Basin²⁴, and according to the project's CRVA, the probability of an 20-year -return extreme precipitation in Panjin City will increase by 20%. The probability of an 30-year-return extreme precipitation in Panjin City will increase by about 30%.

347. In order to take mitigation and adaptation measures to cope with the impact of the above-mentioned climate factors on the region, this project will build infrastructure such as pipeline pumping stations to open up the urban water system and improve the city's climate resilience. After the project is completed, the drainage capacity of Panjin's water system will be able to effectively cope with the current

²⁴ Sun Fenghua, Liu Mingyan, Zhai Qingfei. Prediction and evaluation of climate change and its impact on runoff in Liaohe River Basin[J]. Journal of Meteorology and Environment, 2022, 38(3): 156-161. DOI:10.3969/j.issn.1673-503X.2022.03.019

30-year-return rainfall and the 20-year-return rainfall in the next 30 years under climate change conditions; the number of urban waterlogging sites will be reduced from 73 to 18, and the urban waterlogging inundation area will be reduced from 203.18 hectares to 49.65 hectares.

6.1.2 Improving urban biodiversity

348. Panjin is in the center of the Liaohe River Delta, and its wetland resources have a significant impact on biodiversity. In terms of the characteristics of Panjin's urban biodiversity, birds are undoubtedly the most significant characteristic element. Referring to Section 5.2.3, the distribution of major bird species in Panjin shows obvious regional characteristics, concentrated in the Liaohe River estuary area in the west, which is clearly defined as (I) ecological conservation and tourism development area. In addition, the baseline survey shows that the distribution of birds in the central built-up area of Panjin, where this project is located, also shows a relatively wide distribution pattern, which fully demonstrates the good ecological conditions in the urban area of Panjin for bird habitats.

349. Panjin City has built an urban green space ecosystem with park green space as the main body and road greening as the framework, and has constructed a complex plant community, providing a suitable ecological environment for a variety of birds to live in. According to the "Panjin City Central Urban Green Space Plan", Panjin City has delineated 41 urban green spaces including lakeside parks, covering three categories: park green space, protective green space and other green space, with an area of 4,507.5 hectares.

350. This project will further improve the biodiversity of Panjin City by increasing the area of suitable bird habitats and improving the quality of habitats. The project will increase green space by 136,172 m², including 21 urban ecological green islands with a total area of 133,028 m², and one green space restoration project involving the pipeline with a total area of 3,144 m². The total green space area (including wetlands) to be transformed and improved is 1.4976 million m². The total area of added areas and improved areas accounts for about 4% of the area designated in the "Panjin City Central Urban Green Space Plan".

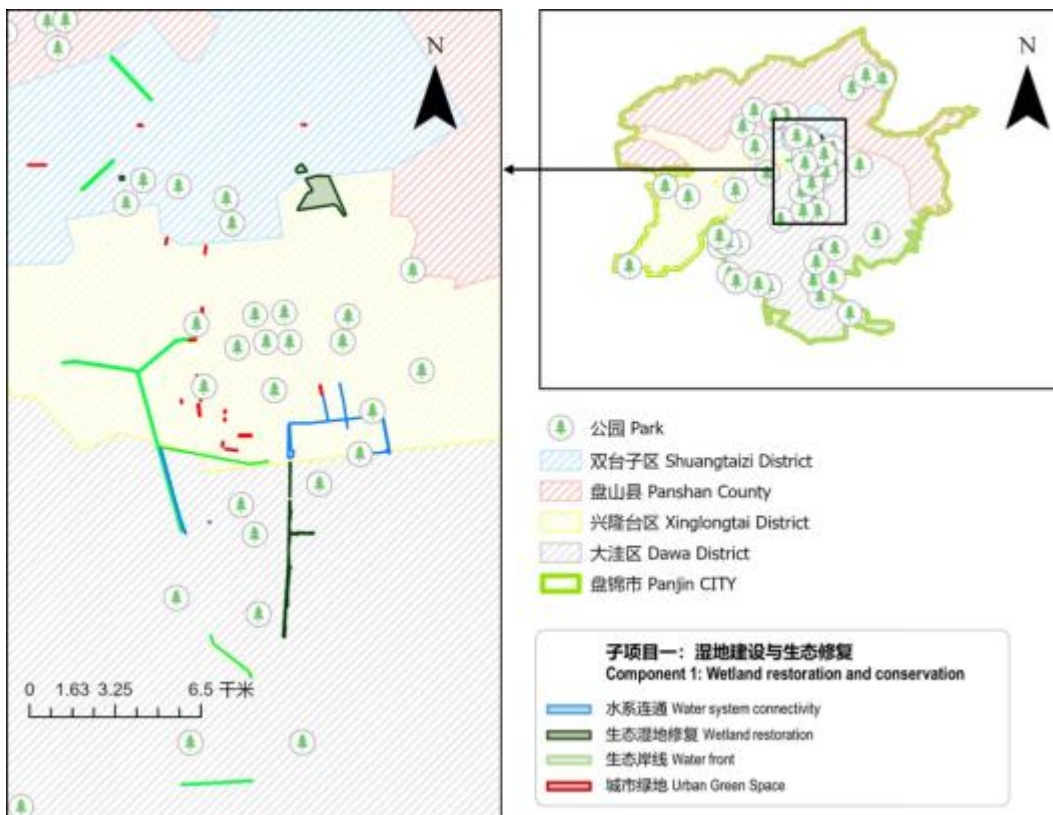


Figure 6-2 Location map of newly added and improved urban green spaces and existing parks in the city

351. Panjin City, due to its significant wetland geographical features, has built many parks, scenic spots and channels with water surfaces and water ecology as prominent features in the urban area. These

places that depend on water provide relatively rich habitat space for urban birds with their unique water environment, which to a certain extent meets the needs of birds for various ecological behaviors such as habitat, foraging and reproduction, and plays a positive role in maintaining the relative stability of urban bird populations.

352. However, the city is currently facing the challenges of insufficient water system connectivity and lack of hydraulic connection of artificial wetlands, which directly leads to poor water quality in some shorelines and channels. As shown in the figure, the channel is located on the north side of Youyi Street and is also one of the project sites of the Urban Drainage Canal Connection Subproject. The water quality of the channel is currently poor. The low quality of urban water environment will undoubtedly have a negative impact on the regional water ecosystem and the biological communities that depend on it for survival, thereby affecting the biodiversity of the region.



Source: ESIA unit

Figure 6-3 Current status of Youyi Street water system connection project

353. In response to the above problems, this project will complete the urban drainage canals connection and ecological coastline improvement, involving a total length of 25,587m of connected urban drainage canals and coastlines. After the project is completed, it is expected that the urban ecological coastline rate will be increased to 45.18%.

354. By implementing these measures, increasing canal connectivity and improving water ecological environment in various urban areas will bring significant benefits to urban biodiversity in many aspects.

355. On the one hand, for birds, the improved water ecological environment will provide a better habitat, thereby enriching the species composition of urban birds and further strengthening Panjin's important position as a migratory stopover and breeding ground for birds. On the other hand, the improvement of the water ecological environment in urban built-up areas will also have a chain reaction on the entire urban ecosystem. Aquatic plants will be able to grow and reproduce better under suitable water quality and water flow conditions. They can not only purify water bodies, but also provide habitats and food sources for many small aquatic animals and insects. These small organisms will attract more amphibians, reptiles and small mammals that feed on them, thus forming a more complete food web structure and improving the stability and biodiversity of the urban ecosystem.

356. In summary, this project is expected to promote the development of regional biodiversity in all aspects on the basis of increasing the area and quality of bird habitats in Panjin urban area through the construction of urban green spaces, the transformation of ecological coastlines and the improvement of water ecological environment.

6.1.3 Improving the ecological environment of the Liaohe River estuary wetland, the downstream of the project

357. Panjin City is located in the lower reaches of the Liaohe River Basin in Northeast China. It is an important biodiversity functional area in China's northern coastal areas. Its ecological environment is related to the ecological security of China's Bohai Rim region, and is also related to the ecological civilization construction and sustainable development in Northeast China. However, long-term urbanization and industrial and agricultural development have caused certain damage to the ecosystem of the Liaohe River Basin, and the Liaohe River Estuary Wetland Area has been under great ecological and environmental pressure. In recent years, the Panjin Municipal Government has carried out many

ecological restoration projects, including reverting well to wetland, reverting aquaculture to beach, damaged wetland restoration, watershed management, and biodiversity protection, with a total investment of tens of billions of yuan and achieved good results, but there are still certain problems.

358. The Liaohe Estuary Wetland is subject to long-term, cumulative impacts from upstream water pollution. In the context of the river basin ecosystem, sewage and pollutants generated by various production and living activities in the upstream area continue to converge downstream with the flow of river water. The survey data of surface water environmental quality baseline in Section 5.4.3 show that the control section of the downstream of the Liaohe River in Panjin can reach Class II and Class III water quality during the dry season (December-January), while in the flood season (July-August), most of them are Class IV water quality. One of the reasons is that with the increase in precipitation, the mixed flow of rainwater and sewage in the urban area of Panjin during the rainy season produces sewage overflow pollution, which further deteriorates the water quality.

359. There are currently 35 drainage zones in Panjin City. This project will carry out rainwater and sewage diversion transformation in 30 of them, involving a transformation area accounting for 82.7% of the total drainage area. After the transformation, urban sewage can be effectively collected to avoid the mixing of sewage and rainwater, thereby reducing overflow, non-point source pollution and other problems. It is expected that the overflow sewage volume can be reduced by 18.0675 million m³/a and the COD pollution reduction emission can be achieved by 4525.8t/a. The reduction of pollution discharge will reduce the pollution load on the water environment, help improve the water quality of the Liaohe River Estuary, the downstream of the project, providing a better living environment for aquatic organisms, and promoting the improvement of the ecological environment of the Liaohe River Estuary Wetland.

6.2 Project Environmental Impact Analysis and Mitigation Measures

360. This section will analyze main environmental impacts of engineering during the construction and operation phase, and identify the main environmental protection objectives and specific measures.

6.2.1 Environmental Impacts of Engineering Analysis

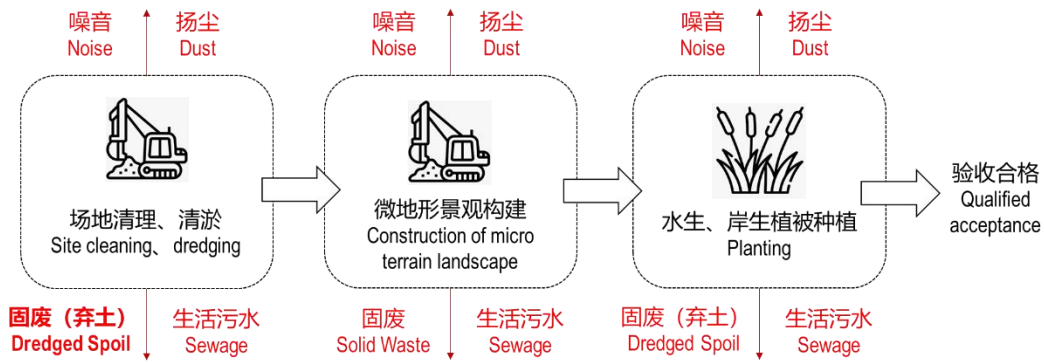
361. This project includes four components: (i) Wetland restoration and conservation, (ii) Sponge city infrastructure transformation, (iii) Digitalization of urban drainage management system and (iv) capacity building. The involved construction and engineering are mainly concentrated in the first two components. The physical engineering of the project can be divided into the following categories: a) wetland landscape; b) park; c) coastline and riverbank; d) pipelines; e) road; f) pump station; g) channel; h) bridge.

362. This section will through the construction and operation analysis of various types of projects, will identify the main pollution-producing links in each stage of the project, and use the matrix method to preliminarily identify the possible environmental impacts of project activities (Table 6-1). The intersection of rows and columns is used to describe the degree and characteristics of the impact of project activities on various environmental factors. These impacts include positive or negative impacts, continuous or temporary impacts, direct or indirect impacts. The environmental and social protection objectives are identified based on the project impacts and surrounding conditions.

6.2.1.1 Construction processes and influencing procedures

(i) Wetland Landscape:

363. This type of project will plant wetland plants such as reeds and lotus, and adopt artificial planting. Before planting wetland vegetation such as reeds, it is necessary to clean up some restoration areas and restore the elevation, and carry out ecological dredging of ponds, and form the microtopographic landscape by using the excavation earth and refilling earth. Mechanical restoration such as excavators are mainly used, and manual work is used as an auxiliary method. Sponge-type squares and trails are built, such as the "Liaohe Stele Park Wetland Restoration and Improvement Project". Their construction process and pollution-generating procedures are shown in the figure below.



Source: ESIA

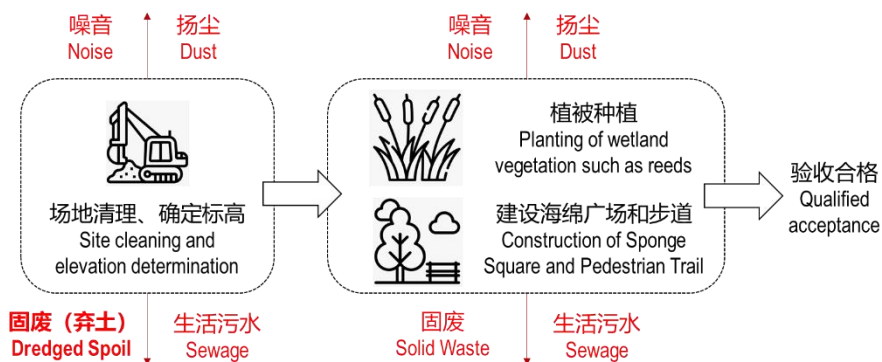
Figure 6-4 Wetland landscape construction procedures and pollution characteristics

364. The construction features of concern include (i) a large amount of wetland renovation and excavation, such as the wetland renovation and excavation of the Yangjia Canal Wetland Park project, which is about 64,000 m³, and the earthwork volume of the Hundred-acre Lotus Pond ecological restoration project, which is about 71,000 m³; (ii) a large amount of greening projects, such as the Liaohe Sluice Park Ecological Restoration and Improvement Project, which will replant about 3,500 trees or sub-trees. (iii) Panjin Wetland is an important "transit station" on the East Asian-Australasian bird migration route. Such wetlands may be habitats for birds.

365. Therefore, the negative environmental impacts of this section include: soil erosion; treatment of garden waste and construction waste; construction noise and light pollution may affect bird behavior. The positive environmental impacts include: area increase; enhanced regional climate adaptability; increased carbon sinks; enhanced wetland ecosystem functions, and improved habitat area and quality for wild animals, especially for birds.

(iii) Park engineering

366. The type of engineering includes greening engineering of streets, roadsides and bank of canals, construction of pedestrians including leisure equipment and benches, renovation of greenspaces to sunken greenspaces, renovation of sidewalk trees to trees garden integrated with sponge city concept that can absorb runoff, etc. The construction processes and pollution-generating procedures are relatively simple, including site cleaning, facility installation and greening. This project activity has less quantities of engineering, with shorter construction time. The environmental impacts focused on the engineering include: noise of facility installation, influence of dust on the nearby communities; the positive environmental impacts include: increase of carbon sink, etc.

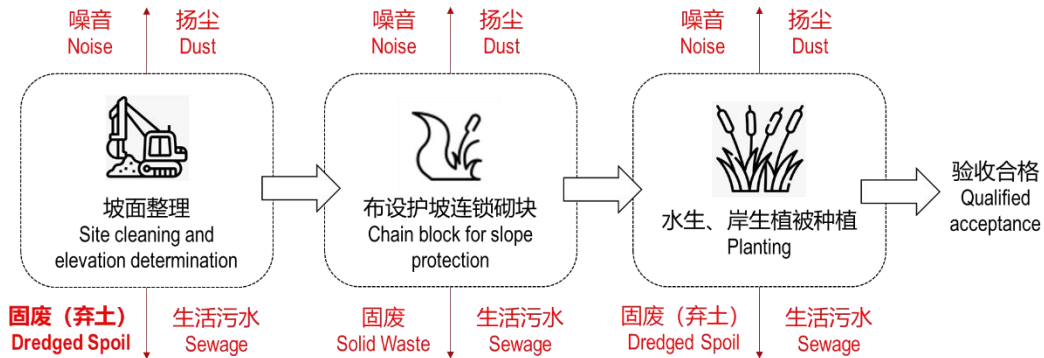


Source: ESIA unit

Figure 6-5 Construction procedures and pollution-generating features of park engineering

(iii) Coastline and Riverbank Engineering

367. This type of project mainly involves the arrangement of the bank slope type, the layout of the slope protection interlocking blocks, the planting of green slopes, and the planting of aquatic plants at the foot of the slope and in shallow water. The construction adopts a mechanical + manual construction method, with machinery as the main method. The construction process and pollution-generating procedures are shown in the figure below.



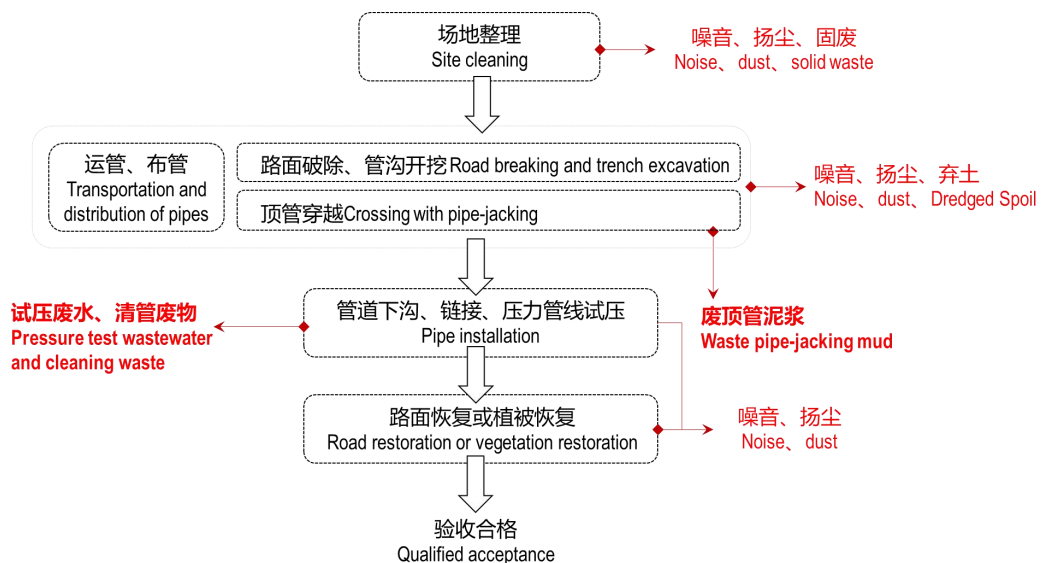
Source: ESIA unit

Figure 6-6 Construction procedures and pollution characteristics of coastline and riverbank engineering

368. The environmental impacts of this engineering include: garbage disposal and silt treatment during river cleaning; the impact of excavation on river water quality, especially suspended matter; positive environmental impacts include: reduced riverbank erosion; increased plant biomass; and increased carbon sinks.

(iv) Pipeline construction

369. This project will complete the rainwater and sewage diversion transformation and build new drainage pipelines. The temporary stockpile yard for this engineering is set up in the project area operation zone, and no additional land is occupied. The entire pipeline construction process is completed by a professional construction team with corresponding construction machinery and equipment. According to the situation, excavation and pipe jacking method and other construction methods are adopted, which are mainly mechanical construction methods, supplemented by manual cooperation. The pipeline construction process is shown in the figure below.



Source: ESIA unit

Figure 6-7 Pipeline construction procedures and pollution characteristics of pipeline engineering

370. The pipeline construction procedure mainly includes the following steps:

371. Site cleaning for surveying and laying out: Before pipeline construction, surveying and laying out is required, marking the center line of the pipeline and the edge line of the construction zone, and then cleaning the site within the operation zone to remove some debris for subsequent personnel and equipment construction. After the site is cleaned, the pipeline can be transported to the construction site.

372. Road demolition and trench excavation in general areas: The road demolition is mainly carried out by rammers, and then excavated by excavators, and local impact drills are used. Pipelines crossing other non-road sections are generally constructed by large excavation. During excavation, the topsoil and the lower soil are piled separately, and the trench is backfilled in the order of the lower soil and the topsoil. After backfilling, there is a natural settlement margin (higher than the ground) above the trench. The excess soil is used first for leveling the project area, and the remaining part is used for leveling nearby.

373. Laneway construction: Part of the pipeline engineering of this project is constructed in the lanes of the old city. For example, the construction space at such engineering sites is not large. In order to reduce the width of the construction zone and increase the temporary land occupation, the excavator is used to dig in reverse, no soil is placed on the ditch side (the soil is transported by the soil truck as it is dug), and the pipeline is not placed on the ditch side (it is transported to the site by the soil truck when it enters the site, and then transported by the excavator to the excavated trench). The pipeline is laid as the excavation is carried out, and the backfill is carried out by the soil truck, and the excavator is used for sorting.

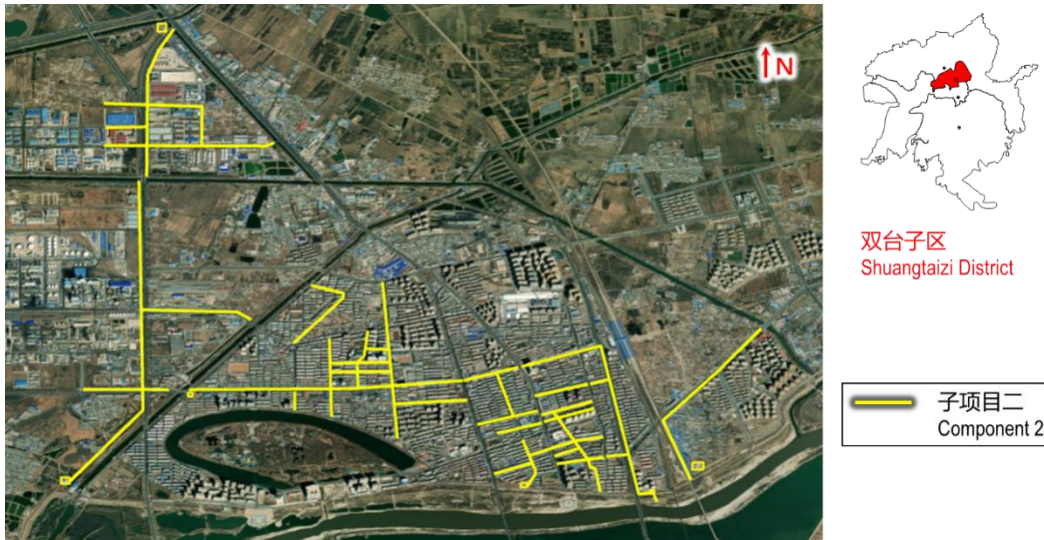
374. Pipe jacking construction: According to the FSR, the project pipeline will adopt pipe jacking construction when crossing some roads (such as Xianghai Avenue) and highways. The total length of the pipe jacking construction section is about 400 m. The construction process of pipe jacking can be roughly divided into the stages of drilling guide holes, pre-expansion, and pipe pulling back. During pipe jacking construction, it is necessary to set up a pipeline welding construction site and a temporary construction site for the entry and exit points.

375. Pipeline connection: The pipe connection adopts the socket connection method. The head of one joint of the two pipe sections is inserted into the tail of the other pipe section in the head-to-tail direction, and the operation is repeated.

376. Pressure test and backfilling: Pressure test is required before backfilling the pressure pipeline. The water supply source for the hydraulic pressure test should be clean and non-corrosive. The pressure test section along the pressure pipeline is determined by the construction unit based on the terrain, water source along the pipeline and other conditions. After the hydraulic pressure test is qualified, the pipeline backfilling work can be carried out. The backfilling needs to be carried out in layers. First, the deep soil is backfilled in the bottom layer, and then the surface soil is backfilled in the top layer. The reverse is not allowed.

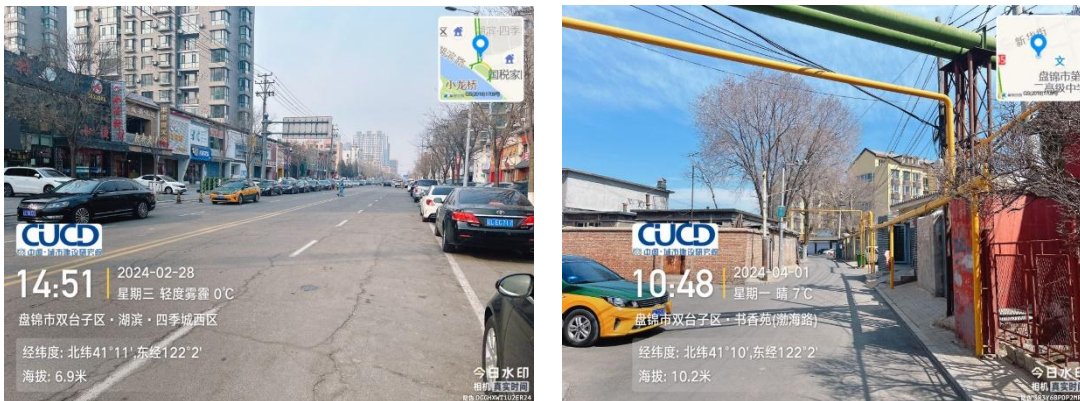
377. Site cleaning, restoration of vegetation and roads: After backfilling, the construction zone needs to be cleaned and vegetation restored. Vegetation restoration can be carried out after cleaning up the debris left over from the construction, which can be done by artificial restoration or natural restoration. The restored species should be the original or local vegetation, and the restoration effect should be consistent with that before construction, and the restoration rate should reach 100%.

378. The construction characteristics of concern include: (1) the on-site construction environment is relatively complex, and the construction space in some areas is limited (see figure). The surrounding communities are relatively close, and most of the project sites are located in the old city. Taking Shuangtaizi District as an example, the protection target range of the pipeline construction basically covers the entire old city, as shown in Figure below; (2) The pipeline construction project is large. The project will build a total of 130.7 km of new drainage pipelines. Most of the new pipelines require breaking the existing roads. After the construction is completed, the roads need to be restored to their original state; (3) The groundwater level in Panjin is relatively high, and the construction precipitation project is large; (4) There are many operations such as cutting and crushing of the road surface, and the noise of construction machinery such as pneumatic picks is relatively large, which is easy to cause dust. (5) The construction time is short. According to the communication with the client and the Housing and Urban-Rural Development Bureau, the pipeline construction period of general sections is within one month.



Source: ESIA unit

Figure 6-8 Satellite image of Component 2 and surroundings in Shuangtaizi District



Gujia Pumping Station Project

Bayi Pumping Station Project

Source: ESIA unit

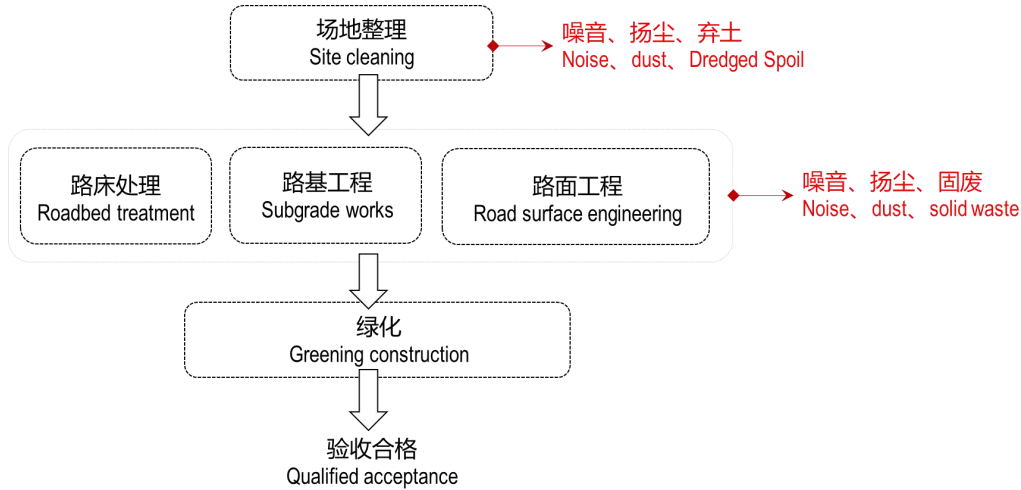
Figure 6-11 Shuangtaizi District - Current Situation Map of the Project Site

379. Therefore, the negative environmental impacts of this engineering include: **noise pollution during construction; dust; construction waste generated by road damage; sludge from pipeline desilting; odor; and the impact of construction precipitation on groundwater.** The positive environmental impacts of such projects include: **reducing the risk of waterlogging; increasing the sewage collection area and reducing non-point source pollution.**

(v) Road construction

380. This project will build two new roads, a total length of 2.24 km, involving land acquisition and demolition: i) Shihua Road South section (Youyi street-Huanchengnan street) stormwater pump station and supporting project will occupy state-owned farm, an area of 134.42 mu, affecting farm employees, a total of 9 households and 35 people. Among them, 125.96 mu of state-owned farm in Xinglongtai District will be occupied, affecting farm employees, a total of 9 households and 35 people; 8.46 mu of suburb state-owned farm in Dawa District, no project-affected people. ii) 28.5 mu of collectively-owned land in Gaojia Village, Tiedong Sub-district, Shuangtaizi District will be occupied because of the construction of new roads, motorized vehicle lanes, pedestrian and green belts of renovation of Gaojia pump station and stormwater and sewage distribution project, affecting 50 households and 153 people. The road construction works mainly include: site cleaning, which requires the removal of all ground obstacles;

roadbed treatment includes topsoil cleaning, gravel backfilling and two layers of lime-improved soil backfilling to ensure that the compaction degree meets the standard; roadbed construction adopts layer-by-layer filling and compaction, controlling the filling speed to ensure slope stability and compaction quality; pavement engineering covers roadbed excavation, gravel cushion layer, cement-stabilized gravel base layer to asphalt surface layer construction. The road construction process is shown in the figure below.



Source: ESIA unit

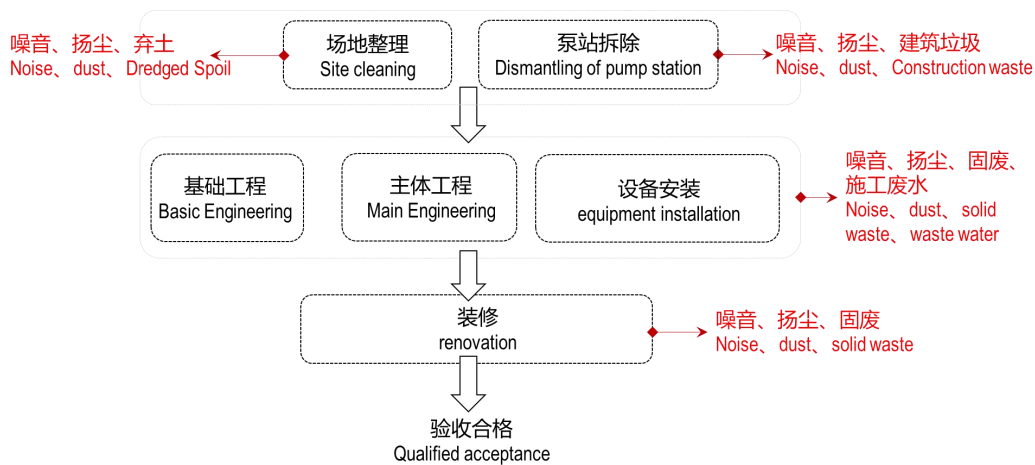
Figure 6-12 Road construction procedures and pollution characteristics

381. The construction features of concern include: (1) the high groundwater level in Panjin requires soil replacement and precipitation; and (2) prevention of non-point source discharge of road sewage.

382. Therefore, the environmental impacts of this section include: **soil conservation, disposal of waste soil, noise, vibration caused by roadbed compaction, dust, exhaust gas from construction machinery, flushing wastewater, etc.**

(vi) Pump station engineering

383. This project will update the old and damaged equipment of drainage pump stations. The construction process of the pump station is shown in the figure below. It mainly includes site cleaning, pump station dismantling, foundation engineering, main engineering, decoration engineering and equipment installation.



Source: ESIA unit

Figure 6-11 Pump station construction procedures and pollution characteristics

384. The construction characteristics of concern include: (i) the project includes the demolition of the pump station; and (ii) the construction period of the main project is relatively long, while the construction time of other construction stages is relatively short.

385. Therefore, the environmental impacts of this section include: **soil conservation, disposal of abandoned soil; disposal of sludge from original pumping stations; odor; noise; dust; exhaust gas from construction machinery; solid waste such as flushing wastewater, broken bricks and waste sand.**

6.2.1.2 Operation process and impact aspects

386. This section will preliminarily identify the impacts and risks of the operation environment through the engineering operation process and the environmental status of the project site.

387. For projects such as (i) wetland landscape, (ii) park, and (iii) coastline and riverbank, the main environmental impacts during the operation period are the treatment and disposal of garden waste, park domestic waste, and sewage.

388. For (vi) pump station projects, the main environmental impacts during the operation period are the treatment and disposal of grille residue and dredging sludge, pump station odor, and noise and vibration from the operation of pump station machinery. In addition, during the operation period of the pump station, attention should also be paid to the waste oil generated by equipment maintenance. According to the National List of Hazardous Wastes (2021), it is classified as hazardous waste with the waste number HW08 (900-214-08).

389. For (iv) pipeline projects and (vii) channel projects, the operation process generally does not produce any environmental impact, but there may be intermittent air pollution and solid waste caused by regular sludge desilting.

390. For (v) road projects, the main environmental impacts during the operation period are vehicle exhaust and noise generated by vehicle travel.

6.2.1.3 Environmental Impact Identification Matrix

391. This section will preliminarily identify the impacts and risks of the operation environment through the engineering operation process and the environmental status of the project site.

392. From Sections 6.2.1.1 and 6.2.1.2 that the environmental impacts during the project construction period mainly come from the construction activities themselves, including related noise, dust, construction wastewater, soil erosion, construction solid waste and slag disposal, environmental sanitation of the construction camp, and the impact on the habitat of nearby wetland birds. The main environmental impacts during the project operation period include vehicle exhaust and noise generated by vehicle driving, pump station noise and vibration, pump station, pipeline dredging sludge and odor, garden garbage, etc.

Table 6-1 Environmental impact identification matrix

Stage	Activities / aspects	Characteristic		Impact			Direct / indirect	Duration
		Negative	Positive	Slight	Generally	Serious		
Construction period	The operation of construction machinery and transport vehicles will generate certain noise and vibration	√			√		Direct	Short term
	Construction noise, construction wastewater, dust, and soil erosion caused by earth excavation and material transportation during road construction and pipeline laying	√			√		Direct	Short term
	Abandoned soil generated by earthwork excavation and filling, sludge from pipeline desilting, riverbed mud and other construction waste	√			√		Direct	Short term
	Domestic waste and sewage generated by construction camps and the additional load on municipal treatment facilities	√		√			Direct	Short term
	Traffic safety and community safety in construction activities such as road construction and pipeline laying	√			√		Direct	Short term
	Temporary interruption of public service facilities such as water supply and electricity caused by excavation	√			√		Direct	Short term
	Construction activities: Noise and light may affect migratory birds that stop at coastal wetlands in May and September each year.	√			√		Direct	Short term
	The damage to the original ecological environment caused by the land occupied by the project facilities	√			√		Direct	Permanent
Operation Period	Improve Panjin's drainage, roads and other infrastructure and enhance Panjin's climate adaptability.		√			√	Direct	Long term
	Increase the green area of Panjin City, increase the vegetation coverage rate, increase the stability of the ecosystem, and enrich the landscape pattern of Panjin City.		√			√	Direct	Long term

Chapter 6 Environmental Impact and Risk Analysis and Mitigation Measures

Stage	Activities / aspects	Characteristic		Impact			Direct / indirect	Duration
		Negative	Positive	Slight	Generally	Serious		
	Road traffic noise and vehicle exhaust emissions	√			√		Direct	Long term
	Impact of noise and vibration generated by pumping stations on nearby communities	√			√		Direct	Interval
	Impact of odor from pumping stations on nearby communities	√			√		Direct	Interval
	Pump station grille residue, sludge, waste oil	√			√		Direct	Interval
	Garden waste generated during the operation and maintenance of park wetlands	√			√		Direct	Interval
	Improvement of river ecological environment and increase of biological habitats		√			√	Direct	Long-term

6.2.2 Environmental impact prediction and mitigation measures

6.2.2.1 Impacts and Mitigation Measures During the Construction Period

6.2.2.1.1 Ambient air impact analysis and mitigation measures

(i) Construction dust

393. The dust during the construction period will have a certain impact on the air quality of the surrounding environment, mainly because a large amount of dust will escape into the surrounding air during the excavation, backfilling, soil handling, topsoil accumulation, and loading, unloading, transportation, and stacking of building materials during the main construction. Generally, the dust generated by the natural wind at the construction site affects a range of less than 100 meters. The pipeline laying, road engineering, and slope protection engineering of this project are all linear projects, and the building materials and excavated earth and stone will be piled on both sides of the construction line as the construction progresses.

394. During the construction of this project, the dust concentration in the local area of the construction area will exceed the secondary standard requirements in some periods of time, and the main impact targets are construction workers and surrounding communities near the construction area and other environmental protection targets. Among the dust generated at the construction site, inhalable particulate matter (PM10) can usually account for a considerable proportion of the total suspended particulate matter (TSP), which may be as high as 50% or more. This is because construction activities usually stir the surface and produce a large number of fine particles, including PM10 particles that can be suspended in the air and inhaled by the human body. Therefore, the monitoring and control of PM10 is crucial in the air quality management of the construction site.

395. Construction dust is mainly affected by construction intensity, excavation area, wind speed, temperature and humidity. The single projects of this project are mainly linear projects, such as pipelines, roads, river slope protection, etc. The excavation area is small and the construction intensity of single projects is low; the average wind speed in Panjin is 2.8m/s throughout the year, and there are 17 days of strong winds throughout the year.

396. As can be seen from Section 6.2.1.1, the construction of each project of this project is divided into multiple construction stages, and the construction technology of each stage is very different, so the dust emission and emission intensity of different construction stages are also different. Overall, the construction stage of this project can be roughly divided into three stages: leveling and grooving, structural installation, and decoration restoration. According to the research of Tian Gang et al.²⁵, the ratio of dust pollution intensity in each construction stage is "grooving: structure: decoration" equal to "100:67:87", so in the construction of this project, it is necessary to focus on dust control in earthwork stages such as road excavation and site leveling.

(ii) Exhaust from construction machinery and transportation vehicles

397. The vehicles and various fuel-powered machinery at the construction site of this project are relatively scattered, and the exhaust emission source is relatively small. The main pollutants are SO₂, NO_x, CO and incompletely burned THC, which are discontinuous and intermittent emissions. Due to the short construction time, the amount of waste gas generated is small, and the open area around the construction site is conducive to the diffusion of waste gas. At the same time, the waste gas pollution source is intermittent and mobile. After taking measures such as strengthening the maintenance and reasonable operation of mechanical equipment; choosing to use electric tools and low-emission mechanical equipment, prohibiting the use of mechanical equipment that cannot meet emission standards; designing a reasonable construction process, making reasonable construction organization arrangements, reducing repeated operations; and strictly controlling transportation time periods and transportation routes, the exhaust gas of construction machinery and transportation vehicles will not have a significant adverse impact on the surrounding atmospheric environment.

(3) Odors during pipeline desilting and pump station dismantling

²⁵ Study on dust pollution characteristics at different construction stages, Tian Gang

398. The project will produce odor during the process of pipeline desilting and culvert desilting. The odor of water bodies is mainly caused by the fact that when the water body is seriously polluted by organic matter, aerobic microorganisms decompose organic matter in large quantities, and the reoxygenation rate in the water cannot keep up with the aerobic rate, resulting in water hypoxia. Some suspended matter and organic matter precipitate under certain conditions, causing anaerobic microorganisms to multiply and decompose organic matter in large quantities, and the odor (such as amines, ammonia, and hydrogen sulfide) that is difficult to dissolve in water escapes from the water surface and emits an unpleasant odor. The odor intensity is divided into 6 levels based on the olfactory threshold of the odor. The corresponding relationship between odor intensity and odor concentration is shown in Table 6-2.

Table 6-2 Correspondence between odor intensity and odor concentration

Odor intensity	Odor concentration (dimensionless)	Description of the intensity of sensation
0	10	Odorless
1	23	Slightly detectable odor (perception threshold)
2	51	Can identify what kind of smell it is (cognitive threshold)
3	117	Noticeable odor
4	265	stench
5	600	Strong stench

399. The restriction requirement for odor is generally equivalent to 2.5 to 3.5 levels of odor intensity. If the intensity exceeds this range, it is considered that odor pollution has occurred and measures need to be taken. According to analogy analysis ²⁶²⁷, there will be a more obvious odor during the dredging of pipelines. The odor can be greatly reduced 30 meters away and there is basically no odor 80 meters away. Therefore, the impact of odor can be reduced by timely removing sludge and setting up fences to prevent people from approaching.

400. In addition, the temporary storage points of bottom mud, pipeline sludge and silt generated during the slope protection process will produce a certain amount of odor. Therefore, the temporary storage points are far away from residential areas, and fences are set up around the temporary storage points. The silt is removed and transported immediately after it dries, which has little impact on the environment. After the silt is removed, the transportation process will produce a certain amount of odor. Since the silt transportation vehicles are in a closed form, the odor pollution is not great. The transportation process is reasonably planned to avoid transportation on roads with congestion and concentrated residential areas, which has little impact on the environment.

(4) Asphalt fume

401. The roads of this project are paved with commercial concrete, which is purchased and transported to the construction site for paving, and is not mixed on site. Asphalt smoke contains toxic and harmful substances such as THC, TSP and benzo[a]pyrene (B[a]P), which are harmful to the health of operators and surrounding residents. Since the asphalt of this project is purchased from an existing asphalt mixing station in Panjin City, the project itself does not mix asphalt, so only a small amount of asphalt smoke will be generated during the asphalt paving process. The asphalt smoke generated during the construction of the project is relatively small and can be quickly dispersed, which will not have a significant impact on the construction personnel and surrounding corporate staff.

402. In summary, the project construction period will have a certain impact on the ambient air quality around the construction site, but these impacts will disappear with the end of the construction period. Therefore, the project construction period will not cause a significant deterioration in the ambient air quality of the project site.

403. In accordance with the requirements of the Three-Year Action Plan (2018-2020) for Winning the Battle for Blue Skies by the Ministry of Housing and Urban-Rural Development and Liaoning Province, as well as the Implementation Plan for Continuous Improvement of Air Quality in Panjin City, construction sites must achieve "100% Mitigation": on-site fencing, hardened road surface, material covering, wet operations, closed transportation, vehicle washing, and video surveillance.

²⁶ Environmental impact assessment document for the Dalu Town River Improvement Project of Zhenjiang New District Transportation Construction Investment Co., Ltd.

²⁷ Environmental impact assessment document for the rainwater and sewage diversion renovation and pipe network repair project of municipal roads in the Ailaoqu Basin of Xiangtan City

404. The specific measures taken in this project are as follows:

- i) Set up continuous, enclosed steel frame advertising enclosures with a height of no less than 1.8 meters²⁸, along the road construction line;
- ii) When the wind speed is above level 4 and dust is likely to be generated, the construction unit shall suspend earthwork excavation and take effective measures such as covering the piled materials and sprinkling water to reduce dust pollution;
- iii) Construction waste should be removed in a timely manner. If it cannot be removed temporarily, measures such as covering with tarpaulin should be taken. Vehicles transporting sand, stone, cement, earth and other dust-generating materials must be tightly covered and spillage is strictly prohibited;
- iv) In order to reduce the amount of dust, car wash stations are set up at the entrances and exits, and vehicles entering and leaving are washed and sprinkled with water to reduce dust, effectively reducing dust pollution on construction roads and limiting vehicle speeds.
- v) When construction machinery is digging, loading, piling, cutting, or crushing the road surface, measures such as sprinkling water should be taken;
- vi) During the excavation process, water is sprinkled to maintain a certain humidity. The loose and dry topsoil in the construction site should also be sprinkled with water frequently to prevent dust. When backfilling the soil, water should be sprinkled appropriately when the topsoil is dry to prevent dust from flying.
- vii) Backfill the trench in time to ensure that powdery materials and bare soil are tightly covered
- viii) Strengthen the management of backfill earthwork storage sites, formulate measures such as earthwork surface compaction, regular water spraying, and covering; unnecessary soil and construction material waste should be removed in time and should not be piled up for a long time;
- ix) Construction material transport vehicles should be equipped with anti-spillage equipment as required, and should not be overloaded to ensure that materials do not scatter during transportation. The contractor should formulate a transportation plan for construction materials and slag, including the routes and times of transportation vehicles, and try to avoid driving in sensitive areas such as busy areas, traffic-concentrated areas and residential areas;
- x) For materials that are prone to generate dust, measures such as covering with dust-proof nets, spraying dust suppressants or sprinkling water should be taken, and temporary soil storage areas should be covered with tarpaulins;
- xi) Transport vehicles should be covered with canopies and loading and unloading sites should be cleaned before loading and unloading to reduce the amount of dirt carried by wheels and chassis and scattered on the road surface;
- xii) The dirt spilled on the road during transportation should be cleaned up in time to reduce dust during operation;
- xiii) During the construction process, it is strictly prohibited to burn waste construction materials as fuel.
- xiv) Asphalt concrete is purchased from a professional mixing station with larger scale and better equipment, which avoids the harmful gases produced when asphalt melts, and the asphalt fume pollution during paving is relatively small. When the construction section passes through a sensitive point-intensive area, attention should be paid to wind direction changes during asphalt paving. Asphalt paving can only be carried out when the operation area is downwind of the sensitive point, so as to avoid the spread of asphalt fume to environmental sensitive points during paving operations and reduce the impact on people's health.
- xv) Information such as dust prevention and control measures, responsible persons, and complaint and reporting telephone numbers should be posted in prominent locations at the entrances and exits of

²⁸ Standing Committee of the Liaoning Provincial People's Congress, Liaoning Provincial Air Pollution Prevention and Control Regulations (2020 Amendment), amended on March 30, 2020

the construction site.

6.2.2.1.2 Noise impact analysis and mitigation measures

(i) Characteristics of construction noise pollution sources

405. During the construction of a construction project, many construction machines and transport vehicles are required, including excavators, bulldozers, loaders, rollers, etc., and transport vehicles include various trucks and dump trucks. The noise pollution generated by the project can be regarded as a fixed noise source. The construction of roads and drainage networks in this project is different from general construction, and the noise generated is also unique, mainly manifested in the following points:

- ① There are many types of construction machinery. Different construction stages have different construction machinery. The number of construction machinery used in the same construction stage also varies. This makes construction noise accidental.
- ② The noise source characteristics of different equipment are different. Some equipment has vibration, sudden and pulse characteristics of noise, which has a greater impact on people; some equipment has a low frequency, is not easy to attenuate, and makes people feel irritated; the noise of construction machinery is relatively large, but the sound level difference between them is still very large. The operating noise of some equipment can be as high as 90dB or more.
- ③ Construction noise sources are different from general fixed noise sources. There are both fixed noise sources and mobile noise sources. Construction machinery is often exposed outdoors, and they will move within a certain small range for a period of time. Compared with fixed noise sources, this increases the noise pollution range during this period of time, but compared with mobile noise sources, construction noise pollution is still within a local range.
- ④ The construction equipment and the range it affects are relatively small, so the noise from the construction equipment can basically be regarded as a point sound source.
- ⑤ For a specific section of road, construction noise pollution only occurs within a certain period of time.

(ii) Prediction model

406. The construction machinery is regarded as a point sound source, and the prediction model of the point sound source impact in the semi-free sound field is:

$$L_{\text{施}} = L_0 - 20 \lg \frac{r}{r_0}$$

Where: L_0 -- construction machinery noise level at the measuring point at a distance of r_0 (m) from the sound source, dB;

r -- The distance between the prediction point and the construction machinery (m).

407. Without considering the noise attenuation of green belts and buildings, the predicted results of noise values of various types of construction machinery at different distances are shown in Table 6-2.

**Table 6-3 Noise level of main construction machinery without measures at different distances
Unit: dB (A)**

No.	Mechanical Type	Source (5m)	Distance from construction site (m)							
			10	20	30	40	60	100	140	200
1	Pneumatic pick	90	84.0	78.0	74.4	71.9	68.4	64.0	61.1	58.0
2	Loader	90	84.0	78.0	74.4	71.9	68.4	64.0	61.1	58.0
3	Bulldozer	86	80.0	74.0	70.4	67.9	64.4	60.0	57.1	54.0
4	Excavator	84	78.0	72.0	68.4	65.9	62.4	58.0	55.1	52.0

No.	Mechanical Type	Source (5m)	Distance from construction site (m)							
			10	20	30	40	60	100	140	200
5	Drilling rig	74	68.0	62.0	58.4	55.9	52.4	48.0	45.1	42.0
6	Crane	74	68.0	62.0	58.4	55.9	52.4	48.0	45.1	42.0
7	Roller	86	80.0	74.0	70.4	67.9	64.4	60.0	57.1	54.0
8	Motor grader	90	84.0	78.0	74.4	71.9	68.4	64.0	61.1	58.0
9	Paving machine	87	81.0	75.0	71.4	68.9	65.4	61.0	58.1	55.0
10	Vibrator	93	87.0	81.0	77.4	74.9	71.4	67.0	64.1	61.0
11	Earth tamping machine	93	87.0	81.0	77.4	74.9	71.4	67.0	64.1	61.0

408. Due to the high intensity of the noise source of construction machinery, when a single machine is operating, the noise at the construction site boundary will exceed the daytime standard (70dB) of the "Environmental Noise Emission Standard for Construction Site Boundaries" (GB12523-2011) at 60-100m, and will still exceed the nighttime standard (55dB) at 200m.

409. According to the on-site investigation, during the construction of pipelines and other projects, the distance between construction machinery and the construction site is relatively close, making it difficult to meet the distance requirement of 60m. In addition, in actual operations, multiple construction machinery often operate together, so the noise impact range during the construction period will exceed the range of 60m during the day. Therefore, it is recommended to take noise reduction measures such as shock absorption and sound insulation for construction machinery, and set up sound insulation fences around the construction site. After analogy with similar projects, the noise reduction effect of the above noise reduction measures is 20-30dB (A) (taking 25dB (A)). After taking the noise prevention and control measures proposed in this environmental impact assessment, the site boundary can only meet the standards within 5m of a single construction machinery. Then, through reasonable layout of the construction site, the noise at the project construction site boundary can meet the "Environmental Noise Emission Standards for Construction Site Boundaries" (GB12523-2011).

410. This project has many environmental protection targets, and construction machinery also poses a hazard to operators and on-site construction personnel. Noise prevention measures should be taken during construction, and continuous temporary sound insulation screens should be set up on the construction road section to reduce the impact of construction equipment noise on employees of surrounding companies.

411. Acoustic environment protection measures during construction period:

i) Select low-noise construction machinery and equipment

412. When signing a contract with a construction unit, the construction unit should require that the main mechanical equipment used by the construction unit be low-noise mechanical equipment. During the construction process, the construction unit must select construction machinery and transportation vehicles that meet relevant national standards, and select various types of low-noise and low-vibration construction machinery and equipment. Fixed mechanical equipment with large vibrations should be equipped with vibration-damping machine bases, and fixed strong noise sources should consider installing soundproof covers (such as power generation vehicles, etc.). At the same time, the maintenance and care of various types of construction equipment should be strengthened to keep them in good operation, so as to fundamentally reduce the strength of the noise source.

ii) Setting up temporary soundproofing screens

413. For construction machinery and equipment sites that emit high-intensity noise, continuous temporary sound insulation baffles or sound-absorbing barriers should be set up on the side close to the environmental protection target to reduce the impact of construction noise on residents. Long-term exposure to high-decibel noise, especially continuous noise exceeding 85 decibels, may cause hearing loss to construction workers. Provide earplugs or earmuffs for workers exposed to high noise to reduce

the impact on hearing.

iii) Reasonable layout of the construction site

414. Reasonable and scientific layout of the construction site is the main way to reduce construction noise. For example, the fixed vibration sources at the construction site can be relatively concentrated to reduce the scope of impact; fixed mechanical equipment such as air compressors and generators can be placed in temporary rooms at the construction site, and sound insulation panels can be installed in the house to reduce noise; avoid using multiple high-noise mechanical equipment at the same site and at the same time.

iv) Reasonable arrangement of construction work time

415. Nighttime construction (22:00-6:00) is prohibited. If continuous operation is required due to construction technology, the construction unit should contact the local environmental protection department and urban management department in a timely manner according to the specific situation, apply for a nighttime construction permit in accordance with regulations, and publish an announcement to maximize the understanding of employees of surrounding companies that may be affected.

416. Within seven days before the high school entrance examination and the college entrance examination, and from 18:00 to 8:00 the next day during the high school entrance examination and the college entrance examination. During the high school entrance examination and the college entrance examination, all construction work that generates environmental noise pollution is prohibited within 500 meters around the examination site.

v) Reasonably arrange the routes and time of construction transportation vehicles

417. Construction transport vehicles, especially large transport vehicles, should determine reasonable transport routes and times in accordance with the regulations of relevant departments. The main transport roads should be as far away from sensitive points such as residential buildings as possible, and no-honking signs should be set up at sensitive points that cannot be avoided. Stop or reduce the operation of construction transport vehicles during peak traffic hours to reduce the impact of transport traffic noise.

vi) Advocate scientific management and civilized construction

418. Strengthen scientific management of construction sites and educate construction workers on environmental protection awareness; vigorously advocate the consciousness of civilized construction and reduce the increase of construction noise caused by human factors.

vii) Strengthen environmental management and accept environmental supervision from environmental protection departments

419. In order to effectively control the impact of construction noise on the urban environment, in addition to implementing relevant control measures, environmental management must also be strengthened; in accordance with relevant national and local laws, decrees, regulations and provisions, construction units should actively accept the supervision, management and inspection of environmental protection departments; when construction units undertake project contracts, they should include relevant construction noise control in the contract content, and appoint specific personnel to be responsible during the construction and project supervision process to ensure the implementation of construction noise control measures.

viii) Construction units must implement various construction management systems

420. Construction units must ensure that construction noise meets the "Environmental Noise Emission Standards for Construction Sites" (GB12523-2011) and conscientiously implement the "Noise Pollution Prevention and Control Law of the People's Republic of China" and other relevant national and local regulations.

ix) Carry out acoustic environment monitoring during the construction period and take corresponding noise prevention and control measures based on the monitoring results.

x) The construction unit should instruct the construction unit to post notices and complaint telephone numbers at the construction site. After receiving a report, the construction unit should contact the local

environmental protection department in a timely manner so as to promptly handle various environmental disputes.

6.2.2.1.3 Water environment impact analysis and mitigation measures

421. This project involves multiple water bodies, including Yitong River, Qingshui River, Pangxieyou River, etc. The wastewater generated during the construction period mainly includes wastewater from concrete maintenance during the construction period, oily wastewater from washing construction machinery and vehicles, domestic sewage from construction workers, and wastewater from pipeline pressure testing. In addition, drainage from slope protection projects and silt drying areas will have a certain impact on surface water quality.

(i) Concrete curing wastewater during construction

422. This project uses commercial concrete and has no concrete mixing wastewater. The water pollution sources such as concrete maintenance wastewater and rainwater erosion generated by construction are related to multiple factors such as construction conditions, construction methods and weather. The main pollutant of concrete maintenance wastewater during the construction period of this project is SS; according to engineering construction experience, general production wastewater is alkaline, and the concentration of suspended solids in water quality is high, with SS concentration reaching 3000mg/L-5000mg/L, and the main components of suspended solids are inorganic substances such as soil particles and cement particles. The project is relatively scattered, and the discharge volume is small. The project discharge water area does not involve water sources and centralized water intakes. This project sets up a temporary sedimentation tank at the temporary construction site, and the treated construction wastewater is all reused for sprinkling water and dust reduction in the construction site. Since the sprinkling water and dust reduction process does not have high requirements for water quality, the wastewater can basically be reused and will not be discharged into the surface water environment, which will not have an adverse impact on the regional surface water environment.

(ii) Wastewater from washing construction machinery and vehicles

423. During the construction period, the maintenance and washing of machinery and vehicles will generate a certain amount of wastewater. The main pollutants are high-concentration suspended sediment and high-concentration petroleum substances. The wastewater from the washing of construction machinery and vehicles needs to be collected and treated centrally, and it is prohibited to discharge directly into water bodies such as Yitong River and Pangxieyou River. Since most of the construction areas of this project are in the urban area, the relevant wastewater can be included in the municipal pipe network after municipal approval. In other cases, an oil separation sedimentation tank can be set up on site. The volume of the vehicle washing sedimentation tank is 2m³. The transport vehicles are washed before leaving the construction area of this project. The vehicle washing wastewater is used for dust reduction after oil separation and sedimentation.

(iii) Domestic sewage

424. The sewage output of construction workers is estimated at 120L per person per day. During the construction of this project, the domestic sewage output of construction workers is about 101.8 m³ / d. The main pollutants of domestic sewage are COD, BOD₅, ammonia nitrogen, SS, etc., with concentrations of about 300mg/L, 200mg/L, 30mg/L, and 200mg/L. The sewage collection network at the project site has been basically laid. The construction site is divided into an operation area, a material storage area, and a living area. It is preliminarily estimated that the living area is only used as an office and resting place, and no accommodation is provided. The actual plan requires the contractor to formulate a detailed construction organization plan after entering the site. If food and accommodation are provided, the basic requirements for construction camp management in the construction camp management plan in Section 12.4 of this report must be met. The contractor shall formulate a specific construction camp management plan based on the construction organization plan and site conditions. For conservative considerations, this assessment considers providing food and accommodation in the living area. The domestic sewage generated in the construction camp is discharged into mobile environmentally friendly toilets and cleaned regularly.

(iv) Support precipitation

425. According to the FSR, the precipitation and support of this project will reach 145 km. During the

support precipitation process, some groundwater may be generated. According to 5.4.5, the water quality of such water bodies is generally good. After reasonable construction management, the amount of water generated is small. It can be used for planting soil for the road greening project of this project, and for sprinkling water in the construction area of the subproject to suppress dust. It is prohibited to discharge directly into natural water bodies.

(v) Pipeline pressure test wastewater and closed water

426. New road construction and other projects will generate a certain amount of pipeline pressure test wastewater, but the amount generated is relatively small. After the pipeline network is laid, a closed water test is required. After the closed water test, the SS in the wastewater increases slightly and can be used for road maintenance and sprinkling.

(vi) Slope protection works and drainage of silt drying areas

427. During the construction of ecological wetland restoration projects represented by the "Liaohu Beilin Park Wetland Ecological Restoration and Improvement Project", ecological dredging will be carried out, that is, excavation of pond sludge, etc. The ecological dredging volume of the "Liaohu Sluice Park Wetland Ecological Restoration and Improvement Project" is 9500m³. This kind of sludge needs to be dried in the sun and then be reused for riverbank and slope in the project sites. Therefore, a certain amount of wastewater will be generated in the temporary drying area. This kind of dried wastewater will meet the third level standard of the "Comprehensive Sewage Discharge Standard" (GB8978-1996) after sedimentation in a small sedimentation tank, and then discharged into the nearby sewage interception pipe, and finally enter the sewage treatment plant for treatment.

428. In addition, all construction materials must not be piled on the shore of the water body to prevent them from being washed into the water body by a heavy rain, and temporary sheltering canvas should be available.

6.2.2.1.4 Solid Waste Impact Analysis and Mitigation Measures

429. Solid waste during the construction period mainly includes domestic waste generated by construction workers, construction waste, and excavated soil and slag. According to the "Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes" (implemented on September 1, 2020), construction units should prepare a construction waste treatment plan before starting construction, take pollution prevention and control measures, and report to the environmental sanitation department of the local government at or above the county level for filing; construction units should promptly remove construction waste and other solid waste generated during the construction process, and utilize or dispose of them in accordance with the regulations of the environmental sanitation department; construction units shall not dump, scatter or pile up construction waste generated during the construction process without authorization.

(i) Household waste

430. The amount of domestic waste generated by construction workers is calculated at 0.5 kg per person per day. The domestic waste output during the construction period of this project is about 130 kg /day. The domestic waste is transported by the sanitation department to the Panjin Municipal Waste Incineration Plant for coordinated treatment with the domestic waste of the entire city. Sufficient classified waste collection bins must be provided at the construction camp and construction site.

431. The Liaoning Panjin Solid Waste Comprehensive Treatment Park is in Lujia Village, Lujia Town, Shuangtaizi District, Panjin City, with a total area of 34.43 hectares and a total investment of approximately 1.27 billion yuan. The first phase covers an area of 19.61 hectares, and the second phase covers an area of 14.82 hectares. The park adopts advanced treatment technology to achieve the recycling of materials and resources, forming a complete recycling chain of materials and processes in the park. At present, the company's domestic waste incineration power generation project has a designed treatment capacity of 1,500t/d.

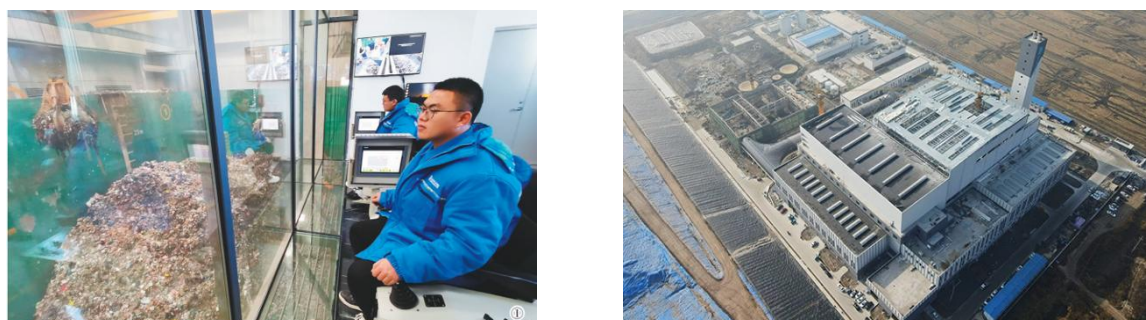


Figure 6-14 Panjin Municipal Waste Incineration Plant

(ii) Construction waste

432. The existing structures need to be demolished during the pump station project. Per square meter of structure demolition could generate 0.8 tons of construction wastes. By the calculation, the amount of construction waste generated during the demolition process is 1392 tons; some construction wastes such as crushed asphalt surface are generated from road excavation during the pipeline construction, which is approximately 7.3 tons based on the area of road damage. Construction wastes will be transferred to Panjin Jincheng Environmental Protection Technology Co., Ltd for treatment. A small amount of sediment tank mud and abandoned soil will be treated by Panjin Jincheng Environmental Technology Co., Ltd.

(iii) Dredging Sludge

433. The dredging sludges in the project are generated from dredging for municipal sewage pipeline, canal dredging and wetland dredging.

434. During the reconstruction of the pump station and the construction of the pipeline, sludge will be generated. The sludge generated during the construction process will be sent to the existing sludge disposal center in Panjin for treatment. The sewage in the municipal pipelines is mainly generated from residential domestic sewage, no industrial wastewater. Therefore, no excessive heavy metal iron is detected in the sewage. These dredging sludges from pipeline are transferred to the Municipal sludge treatment plant of Panjin Jinghuan Environmental Protection Technology Co., Ltd., which is located in the western Panjin, in north of Yugagnzi Village, in South of Guodi embankment, with a designed sludge treatment capacity of 150t/d.

435. The volume of wetland ecological dredging is 150014 m³. According to the early survey, there is no historical heavy metal pollution in the canals involved by the project; and no sewage discharged outlets exist around the project canals. The flows of canals are mainly stormwater. According to sediment quality of chapter 5, there is no excessive heavy metal irons that are detected in dredging sludges. After discussion with FSR unit, Panjin Housing and Urban-Rural Development Bureau and Water Conservancy Bureau, it is known that these dredging sludges need to be dried in the sun and then be reused for riverbank and slope in the project canals, no any abandoned sludges.

(iv) Construction spoil

436. According to the data provided by the FSR, the volume of dredging of the project is 150014 m³, using for riverbank preparation and slopes. The volume of excavation of site preparation is 118362 m³, using for microtopography shape and greening of subprojects. All subprojects can achieve the balance of earthwork, and no external borrowed earthwork. The earthwork volume of this project is shown in the following table:

Table 6-4 Calculation table for earthwork excavation and filling of each subcomponent (unit: m³)

Project Name	Ecological dredging (m ³)			Earthwork (m ³)		
	Generated from dredging	Used for riverbank	Filling used for site preparation	Excavation used for site preparation	Filling used for site preparation	Used for Greening
Yangjia Canal Wetland Park Construction Project	12,000	5,600	6,400	28,800	35,600	0

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Youyi Street Drainage Canal System Connection	10,764	10,764	0	29,862	0	29,862
Liaohu Stele Park Wetland Ecological Restoration and Improvement	9,500	7,900	1,600	6,200	7,800	0
Tianjia Ecological Corridor Project	0	0	0	121,500	66,000	55,500
Hundred-acre lotus pond ecological restoration project	0	0	0	46,000	25,000	21,000

6.2.2.1.5 Ecological impacts and mitigation measures

437. Based on the identification and prediction of ecological and environmental factors and the affected ecological and environmental objects (species, habitats, biological communities, ecosystems and biological diversity), the ecological impact assessment factors of this project are determined²⁸, including species (distribution range, population size, population structure, behavior, etc.), habitats (habitat area, quality, connectivity, etc.), biological communities (species composition, community structure, etc.), ecosystems (vegetation coverage, productivity, biomass, ecosystem function, etc.), and biodiversity (species richness, evenness, dominance, etc.). The ecological and environmental assessment factors of this project are shown in the table below.

Table 6-5 Ecological impact analysis factors during construction period

Affected Objects	Evaluation Factor	Project content and impact (Direct, indirect and cumulative ecological impacts)	Impact Nature (including long-term and short-term, reversible and irreversible)	Impact (Four levels: strong, medium, weak, none)
Species	Distribution range, population size, population structure, behavior, etc.	The operation of mechanical equipment, rolling, earth excavation, etc. in the construction area and temporary construction land directly affects	Short-term, reversible effects	Weak impact
Habitat	Habitat area, quality, connectivity, etc.	The operation of mechanical equipment, rolling, earth excavation, etc. in the construction area and temporary construction land directly affects	Short-term, reversible effects	Weak impact
Biomes	Species composition, community structure, etc.	The operation of mechanical equipment, rolling, earth excavation, etc. in the construction area and temporary construction land directly affects	Short-term, reversible effects	Weak impact
Ecosystem	Vegetation coverage, productivity, biomass, ecosystem function, etc.	The operation of mechanical equipment, rolling, earth excavation, etc. in the construction area and temporary construction land directly affects	Short-term, reversible effects	Weak impact
Biodiversity	Species richness, evenness, dominance, etc.	The operation of mechanical equipment, rolling, earth excavation, etc. in the construction area and temporary construction land directly affects	Short-term, reversible effects	Weak impact
Ecologically sensitive areas	Main protected objects and ecological functions	There is a slight impact on the operation of mechanical equipment, earth excavation, etc. in the construction area	Short-term, reversible effects	Weak impact

²⁸ Technical Guidelines for Environmental Impact Assessment - Ecological Impact HJ-19 2022

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Affected Objects	Evaluation Factor	Project content and impact (Direct, indirect and cumulative ecological impacts)	Impact Nature (including long-term and short-term, reversible and irreversible)	Impact (Four levels: strong, medium, weak, none)
Natural landscape	Landscape diversity and integrity	There will be slight impact on the operation of mechanical equipment, rolling, earth excavation, etc. in the construction area and temporary construction land.	Short-term, reversible effects	Weak impact
Natural monuments	Diversity and integrity of the ruins	Mechanical equipment is running and rolling, earth excavation, etc. in the construction area and temporary construction land, and there are no natural relics in the area	-	No impact

438. Based on the above table, this section focuses on the analysis of terrestrial plants, birds, and aquatic ecosystems.

(i) Analysis of the impact on terrestrial plants

439. During the project construction period, the impact on plant resources is mainly reflected in the construction activities in the project construction area and temporary construction sites. According to the characteristics of the project construction, the greatest impact on the vegetation environment is the disturbance and destruction of surface vegetation by slope protection projects, road projects, station construction and temporary soil dumps.

440. Excavation and occupation of land during construction will directly cause losses to plant biomass and productivity. However, since the area occupied by excavation, earthwork construction and construction roads is very small compared to the entire evaluation area, the occupation and removal of plants will cause less loss to plant biomass and productivity. After the construction is completed, greening and ecological restoration will be carried out in accordance with ecological and environmental protection measures. Surrounding plant species will be able to invade the vacant ecological niches, and the plant communities affected by the construction activities will also be gradually restored in the self-sustaining succession.

441. The temporary land occupation of the project is mainly for construction work belts, construction access roads, temporary soil storage yards, etc. The temporary land occupation is flat, and part of the occupied land is the surrounding grassland. The construction will cause crushing, occupation, stripping and other damage to the surface vegetation in the occupied area, resulting in a short-term loss of biomass of the surface vegetation. However, the flora distributed in the temporary land occupation of the project is mostly widely distributed plant species (such as herbaceous crops such as reeds and mosses). Although the plant population distributed in it will become smaller during the construction period, it will not affect the reproduction of these plant species and cause species extinction. There are no endemic species in the construction area of the project, and the vegetation is widely distributed. The construction of the project will cause some damage to its individuals, but it will not have a serious impact on the protection of its germplasm resources. After the construction is completed, the temporary land occupation will be reclaimed and the ecology will be restored immediately to prevent soil erosion.

442. The project carries out construction activities in the construction blocks and temporary construction sites. Construction machinery, construction access roads, construction personnel activities, etc. will cause temporary damage, crushing and occupation of natural vegetation and natural landscape in the regional blocks. For example, the connection of ditch water systems, ecological revetments and shoreline greening will produce corridor effects on the landscape and affect the connectivity of the region. The construction of blocks, stations, etc. will produce temporary patch effects on the natural landscape.

443. In general, these impacts during the construction period are short-term, reversible and controllable, and the impacts on regional vegetation ecology and biodiversity are acceptable.

(ii) Analysis of impacts on birds

444. In the ecological assessment area of the project's urban construction, such as the scope of the "Renovation of Flood-prone Areas Near Century Square" project, most of the birds are resident birds,

and most of the distributed birds are common local birds (such as sparrows, house martins, magpies, etc.). These birds are already accustomed to the human, industrial and road transportation activities in this area, and the construction of this project will not affect them.

445. During wetland construction projects, such as the "Hundred-acre Lotus Pond Ecological Restoration Project", birds, as a key component of the ecosystem, may be affected to varying degrees in their survival, reproduction, and migration.

446. First, noise pollution during construction is a major challenge for birds. Mechanical noise and other noises generated during construction can interfere with birds' normal communication and affect their courtship, reproduction and other behaviors. For resident birds, long-term noise interference may lead to changes in their habitats and even affect their populations. At the same time, noise may also cause stress reactions in birds and affect their health.

447. Secondly, light pollution during the construction period also has a certain impact on birds. For example, during nighttime construction, the lights used may interfere with the birds' migration routes and cause them to lose their way. Some birds rely on starlight or geomagnetic fields for navigation during migration, and strong artificial light sources may interfere with their navigation systems, causing birds to deviate from their original migration routes or even cause collision accidents. Therefore, nighttime construction is prohibited for this project.

448. In addition, construction activities may also destroy bird habitats. Vegetation and water sources in the protected area are the basis for bird survival. Earth excavation and wetland restoration during construction may destroy bird habitats, causing them to lose food sources and breeding sites. Especially for water birds, the destruction and pollution of water areas may have a fatal impact on their survival.

449. Finally, air pollution during the construction period may also have a negative impact on birds. Pollutants such as dust and exhaust gas during the construction process may enter the respiratory system of birds, causing respiratory diseases and affecting their survival and reproduction. In terms of construction wastewater, turbid water caused by engineering mud, oil leakage from large machinery and improper disposal of various garbage are the direct causes of water pollution, which directly lead to a reduction in the species and number of aquatic organisms, thus affecting the predation of birds.

450. Therefore, the construction of wetland construction and other projects involved in this project should be carried out in a suitable season, avoiding the breeding season and main foraging season of birds as much as possible.

451. During the construction period, the contractor should take the following measures to minimize the impact of the construction team on birds and their habitats:

(a) Construction time management: During the peak periods of bird breeding and migration (March to May, September to November), in the morning (6:00-8:00) and evening (17:00-19:00), when birds are most active, low-noise and low-vibration operations should be prioritized, and large-scale machinery operations and high-noise construction should be avoided.

(b) Environmental protection and education: 1) The contractor provides environmental protection and wildlife protection training to construction workers to ensure that all personnel understand and strictly abide by bird protection measures. The training content should include bird identification, habitat requirements, and how to reduce the impact of birds on the construction team. 2) Display publicity materials about local birds and their protection measures at the construction site to enhance the protection awareness of all participants.

(c) Sewage management: It is prohibited to directly discharge untreated sewage into water bodies such as Pangxiegou and Yitong River.

(d) Noise control: sound barriers shall be set up at the construction site, and work areas and activity scopes shall be demarcated. Construction activities shall be strictly controlled within the demarcated work areas and site scopes.

(e) Light pollution control: Use low-intensity, directional lighting during the construction period to ensure that light only shines on necessary areas and avoids direct exposure to the coastal zone, especially during the bird migration season in spring and autumn. Lighting fixtures should be equipped with light-shielding lampshades to reduce light scattering and interference with birds. Construction vehicles should slow down and use low-energy lights at night to avoid direct exposure to strong light. Turn off unnecessary lights at night.

(f) Vehicle management and maintenance: During the construction process, strengthen the management

and maintenance of transport vehicles to ensure that the vehicles are in good condition. Develop fixed routes for transportation to avoid bird habitats and minimize harmful impacts.

(g) Sufficient garbage and waste collection points should be set up at the construction site to classify and dispose of them in a timely manner; garbage collection points should be covered to prevent garbage from being scattered and touched by birds.

452. In summary, the project has adopted measures such as construction in appropriate seasons and prohibiting construction at night, and the impact on birds is controllable.

(iii) Impact on aquatic ecology

453. Rivers and wetlands are important components of aquatic ecosystems. River cleaning, earth excavation, and wetland restoration construction activities have significant impacts on aquatic ecology and fish.

454. During the period of river channel clearing, earth excavation and wetland restoration construction, environmental factors such as river and wetland flow, water quality, and bottom quality will change significantly, which will have a profound impact on the distribution, species composition and population structure of fish.

455. Earthwork excavation and wetland restoration construction will change the flow state of rivers and wetlands. During the construction process, the flow direction, flow rate, water depth, etc. of the river may change, resulting in the destruction or change of the original habitat of fish. Some fish may migrate because they cannot adapt to the new water flow environment, thus changing their distribution pattern.

456. Earthwork excavation and wetland restoration construction may pollute water quality. Pollutants such as suspended solids and oil generated during construction may enter the water body, causing water quality to deteriorate. Such changes in water quality may have a negative impact on fish's physiological activities such as breathing and feeding, and may even cause fish deaths. At the same time, water quality deterioration may also affect the reproductive capacity of fish, thereby affecting their population structure.

457. Benthic animals, such as insects and crustaceans, mostly live in the bottom sediment of the riverbed and are very sensitive to changes in the structure of the bottom sediment and water quality. Construction may destroy the bottom sediment structure and change the habitat of benthic animals. Pollutants generated by construction may also cause direct harm to benthic animals or affect their living conditions.

458. Earthwork excavation and wetland restoration construction will also change the bottom structure of rivers and wetlands. Excavation operations may destroy the original bottom environment and change the composition and stability of the bottom. This will affect the survival of benthic organisms and further affect the food chain of fish. Fish may decrease in number due to a reduction in food sources, or adjust their species composition due to changes in food types.

459. Emergent and submerged plants are key components of river ecosystems. They stabilize riverbanks, purify water, and provide habitats for organisms. Earthwork excavation may damage the root systems and growth environment of emergent plants, causing plant death or poor growth. This will not only affect the ecological functions of plants, but may also have a negative impact on the stability of the entire river and wetland ecosystem.

460. Some water construction projects may require the installation of cofferdams, such as the "Zhonghua Road Drainage Project", see figure. This construction measure will inevitably have a certain impact on the river aquatic ecosystem.



Source: ESIA unit

Figure 6-13 Current situation map of Zhonghua Road drainage project

461. The setting of a cofferdam will change the speed and direction of the river flow. The cofferdam is equivalent to setting an obstacle in the river, causing the water flow to change near the cofferdam, the flow rate may slow down or the flow direction may change. This change will affect the habitat of aquatic organisms, especially those that require a specific flow rate and direction to survive, which may be greatly affected.

462. Cofferdam construction may damage the bottom structure of the river. During the construction process, it may be necessary to dig the riverbed or riverbank, which will destroy the original bottom structure and affect the habitat and reproduction of aquatic organisms. In addition, harmful substances in the bottom mud may be released during the excavation process, causing water pollution. Cofferdam construction may cause water quality deterioration, such as increasing suspended matter and nutrients, which will affect the survival and reproduction of zooplankton. In addition, changes in water flow during construction may also affect the distribution and migration of zooplankton.

463. The cofferdam will change the hydrological conditions of the river. The water inside the cofferdam needs to be drained to lower the water level, which will cause the water volume in the river to decrease and the water level to drop. This change may affect the living conditions of aquatic life, especially for those that rely on a specific water level to survive, which may threaten their survival.

464. Finally, cofferdam construction may also affect the water quality of the river. Various pollutants may be generated during the construction process, such as wastewater and waste residue. If these pollutants are not properly handled, they may be discharged into the river and pollute the water quality. In addition, if the bottom mud inside the cofferdam is not properly handled, it may also become a source of pollution.

465. In order to reduce this impact, the project adopts the dry construction method of draining the water in the operation area before construction in the appropriate season (winter or dry season), using steel plate cofferdams as much as possible, or constructing diversion channels to reduce the impact of construction on aquatic ecosystems and fish.

466. Ecological monitoring and management should be strengthened during the construction process. At the same time, ecological restoration work should be carried out after the construction is completed to restore the ecological environment of rivers and wetlands and promote the balanced development of aquatic ecosystems.

467. In summary, the project construction period will have a certain impact on the birds, aquatic ecosystems and fish in the construction area, which may force them to temporarily flee the construction area and avoid activities in areas they consider safe. However, with the end of the construction activities,

the construction impact will be eliminated, and these birds, aquatic ecosystems and fish will gradually resume activities in the construction area. The impact of the construction activities on them is temporary and reversible, and the impact is acceptable.

6.2.2.1.5 Soil erosion

468. During the construction of roadbed, pipelines and foundations, the exposed surface and temporary earth piles can easily cause soil erosion and enter water bodies such as Pangxiogou River and Yitong River or drainage systems if not properly protected.

469. When excavating earth and stone, due to the loose structure, a small amount of soil and water loss will occur during rainfall. Therefore, when excavating earth and stone, it is required to set up drainage ditches and sedimentation tanks around the stacking site, and secondly, no excavation work or only small-scale work in the rainy season to minimize the soil and water loss caused by the piled soil. In addition, when excavating earth and stone, a temporary fence should be built, and the storage slope and stacking time of the temporary pile of soil should be reduced. The backfill soil should be compacted in time, drainage ditches should be built at the construction site to prevent rainwater from scouring the site, and sedimentation tanks should be set up at the outlet of the drainage ditch to clarify the rainwater before discharging it. These measures can effectively reduce soil and water loss.

470. Mitigation measures:

(i) Construction site: The construction sites of this project are arranged in the principle of proximity. After the completion of the project construction, temporary facilities should be dismantled in a timely manner, waste in the temporary occupied area should be cleared, and vegetation restoration should be carried out on the site. The planting method should be natural scattered planting, and local common species should be selected to reduce and compensate for the adverse effects caused by the construction.

(ii) Temporary soil dump: During the construction process, the topsoil is stripped and piled in a temporary soil dump. The ground is cleaned in time and watered appropriately. Wind and rain protection measures should be taken at the temporary dump. At the same time, tarpaulin should be used to cover the transportation process to reduce dust. The construction waste soil is used for later greening and the remaining waste soil is transported to the waste dump designated by the construction department for disposal. After the construction is completed, the site is revegetated to restore the original land use function. Local common species are selected for vegetation restoration to reduce and compensate for the adverse effects caused by the construction.

(iii) Excavation and backfilling should be avoided during the rainy season to prevent secondary soil erosion.

(iv) Special intercepting drainage ditches, diversion cofferdams and temporary anti-seepage sedimentation tanks should be set up at construction sites and temporary soil dumps to divert rainwater into the sedimentation tanks for reuse after sedimentation treatment to prevent soil and water loss caused by rainwater erosion.

6.2.2.1.6 Urban Ecological Landscape Impact Analysis and Mitigation Measures

471. The project carries out construction activities in the construction area and temporary construction land. Construction machinery, construction access roads, construction personnel activities, etc. will cause temporary damage, crushing and occupation of natural vegetation and natural landscape in the regional blocks. For example, the connection of ditch water systems, ecological revetments and shoreline greening, pipeline construction, etc. will produce corridor effects on the landscape and affect the connectivity of the region. The construction of urban green island projects will produce temporary patch effects on the natural landscape.

472. In summary, the project construction period will cause damage and losses to reeds, weeds and other areas in the construction area, and will cause adverse effects such as reduction, decrease or destruction of species distribution range, population size, population structure, habitat area, quality, connectivity, community structure, vegetation coverage, productivity, biomass, ecosystem function, species richness and uniformity in the construction area. However, this impact is short-term, reversible and controllable, and the impact on regional vegetation ecology and biodiversity is acceptable.

6.2.2.1.7 Material cultural heritage resources

473. There are no known above-ground material cultural resources in the project area. Some cultural relics may be found during piling and excavation. If cultural relics are found during construction, construction should be stopped immediately to protect the site; the project should be reported to the cultural relics department immediately and measures should be taken according to the requirements of the cultural relics department; construction can only be resumed after obtaining the consent of the cultural relics department.

6.2.2.2 Impacts and Mitigation Measures during Operation Period

6.2.2.2.1 Water environment impact analysis and mitigation measures:

(i) Impact Analysis

i) Analysis of hydrological changes

474. After the project is put into operation, rainwater diversion will be achieved through pumping stations, drainage pipes and drainage ditches, combined with widening or repairing the river channel. The water system connection route is Pangxiogou River-Ring City Water System-Qingshui River, and finally flows into Qingshui River. After the project is put into operation, the flow direction of the existing natural water system will not change. Through dredging the river channel and building ecological slope protection in the project area, the water flow area of the river channel will be increased, the water storage capacity will be increased, the flood discharge capacity will be enhanced, and the ability to cope with extreme rainstorms in summer will be enhanced; through the restoration of ecological wetlands and ecological shorelines, the shape of the water body shoreline will change, and the hydrological situation of the river section will change to a certain extent. Overall, the flood discharge capacity of this river section has been enhanced, and the water storage capacity in normal years has been enhanced.

ii) Analysis of impact on surface water environment

475. The ecological wetland restoration and ecological shoreline projects are ecological environment improvement projects in themselves. There will be no sewage discharge after operation. After the implementation of the project, the original ecological environment of the river will be greatly improved, the river fluidity will be enhanced, the self-purification capacity of the water body will be greatly improved, the problem of black and smelly water bodies (such as the rivers on both sides of Youyi Street, Linfeng Road, and Qingnian Road) will be improved, the flood discharge capacity of rivers and lakes will be improved, and it will have a favorable impact on the surface water environment after operation.

476. After the water system connection project and drainage facility upgrading and renovation project are put into operation, the pressure of water drainage will be effectively relieved, rainwater and sewage will be separated, the frequency of sewage overflow will be reduced, the total amount of pollutants overflowing into the receiving water body will be reduced, and the overflow pollution problem of surface water will be solved. According to the project FSR, after the implementation of the project, the reduction of overflow sewage can be about 18.0675 million m³/a, COD can be reduced by 4525.6 tons/year. After the project is put into operation, it will have a positive impact on the quality of the surrounding surface water environment.

477. During the operation period of the project, the pump station will have 1-2 office staff, with a small number of staff, and the amount of domestic sewage generated is small. The domestic sewage generated by the office staff in the pump station is discharged into the sewage treatment plant where the sewage partition of the pump station is located through the interception main pipe for treatment. It will not be discharged outside and will not have an adverse impact on the surface water quality. Therefore, the domestic sewage generated by the pump station has little impact on the surrounding surface water environment.

478. In general, after the normal operation of this project, it will not have a significant adverse effect on the river's self-purification capacity and pollution absorption capacity, and will have a positive impact on the surrounding surface water environment. No pollutants will be generated during the operation and no pollution will be caused to the water quality. However, since the area involved is relatively dispersed, there may be hidden dangers of water quality degradation if the prevention and control of water pollution sources in the basin and prevention of emergencies are not done well.

iii) Analysis of impact on groundwater environment

479. During the monitoring period, the groundwater level is generally between -1m and -3m. From the groundwater level line, the water level in highland and river is high, and the groundwater is replenished to the middle depression. The water system connection project of this project is mainly to connect the ditch and wetland water system. The location and facilities of the water inlet and outlet of each block have not changed. After the connection, the elevation of the water system has not changed, and the area of the district system has remained basically unchanged, so it will not have a significant impact on the groundwater level in the project area.

480. The water system connection, ecological wetland restoration, and ecological bank protection project itself is an ecological environment improvement project. After operation, no sewage is generated or discharged. The water bodies in the area are all natural water bodies. According to monitoring, the surface water bodies can meet the Class IV standard in the "Surface Water Environmental Quality Standard" (GB3838-2002). According to the monitoring results of the sediment in the project area, the sediment quality at each monitoring point meets the requirements of the agricultural land soil pollution risk screening value (basic project) of the "Soil Environmental Quality Agricultural Land Soil Pollution Risk Control Standard (Trial)" (GB15618-2018). Therefore, the sediment quality within the river and wetland involved in the project is good. The surface water bodies that naturally accumulate and settle in the area during the project operation period will basically have no impact on the groundwater in the area. Due to the construction of the sponge city project, there is a weak replenishment effect on the shallow groundwater in the region.

481. After the drainage facility upgrading and renovation project was put into operation, rainwater and sewage were separated. The sewage was discharged through the replacement or repair of collapsed rainwater pipes along Zhonghua Road (Taiping River Pumping Station ~ Jinpanhe Street Pumping Station) north of the Liaohe River and the Yitonghe District. After operation, the problem of rainwater and sewage leakage into groundwater was improved, reducing the risk of groundwater pollution.

482. During the operation period, if the pipeline is broken or leaking due to non-construction according to specifications, worker operation errors, ground temperature changes, human damage, etc., there is still a risk of sewage overflow and contamination of the groundwater environment. This situation is random, accidental and unpredictable. As the fault is eliminated, the sewage overflow caused by the accident will also end, and its impact is short-lived.

(ii) Mitigation Measures

483. During the design, construction and operation, strengthen management to ensure the normal operation of the pipeline network; formulate emergency plans to prevent adverse consequences when problems arise.

484. During the operation period, inspections of sewage pipelines should be strengthened to promptly detect pipeline collapse and leakage, and to promptly handle them to avoid the possibility of groundwater pollution caused by leakage in the sewage pipeline network.

485. During the pipeline network construction process, inspection wells are set up at appropriate distances, and special personnel are arranged to inspect and maintain the pipelines in sections to ensure that when a pipeline leakage accident occurs, maintenance personnel can discover it in time and take appropriate measures.

486. Strengthen the maintenance of the drainage system and regularly desilt the drainage system to ensure smooth drainage of precipitation.

487. In order to prevent overflow caused by pump station failure, it is recommended that the construction unit build an accident emergency pool to collect sewage overflow caused by pump station accidents. After collection, the sewage will be transferred into the sewage network by the lifting pump and finally treated at the sewage treatment plant.

488. Determine the engineering personnel for pipeline operation and maintenance. In order to ensure the normal operation and regular maintenance of the pipeline system, provide targeted training for professional technicians and workers so that they have a good environmental awareness, are familiar with the pipeline operating procedures, understand the technical performance and maintenance and operation methods of the equipment used, and are familiar with the maintenance of the equipment.

489. Establish an emergency accident handling mechanism. When a pipeline leakage accident occurs, the person who discovers it should report it to the emergency accident handling leading group as soon

as possible, and take emergency measures to prevent the accident from expanding.

6.2.2.2 Biodiversity impact analysis and mitigation measures

(i) Impact Analysis

490. This project does not occupy any nature reserve. There are no rare vegetation or rare protected animals within the assessment scope, and the distributed plants and animals are all common species.

491. Terrestrial vegetation: The impact of construction will gradually subside during the operation period, the temporary land occupation will be restored, and the plant seeds remaining in the topsoil will be able to re-sprout to form a vegetation community consistent with the surrounding area. After the implementation of the wetland construction project, the vegetation structure of different heights and densities has been changed, including the tree layer, shrub layer and herbaceous layer. The artificial greening vegetation system is mainly used, which replaces the original dominant population of the project, resulting in a new community succession. The newly planted vegetation community and the native vegetation are in a competitive relationship, competing for sunlight, air and soil moisture, affecting vegetation diversity. During the operation period of the drainage facility upgrading and renovation project, the impact of personnel on the activities of equipment, pipeline inspections, and maintenance personnel is controllable, and there is no impact on terrestrial plants in the surrounding area.

492. Aquatic vegetation: During the operation period, with the completion of water system connectivity, wetland restoration, vegetation restoration, and shoreline greening projects, aquatic vegetation gradually grew luxuriantly. Newly planted aquatic vegetation included lotus, water lily, reed, calamus, cattail, water plantain, loosestrife, and water lily, enriching the species and community structure of aquatic plants and having a positive impact on the diversity of aquatic vegetation.

493. Plankton: After the project is completed, the river flow will tend to be stable, the water quality will be restored and improved, which is conducive to the growth of phytoplankton; at the same time, the community structure of some phytoplankton will change from the original pond and puddle type to the river type community, the biodiversity will be improved, and the environment and landscape quality will be enhanced.

494. Benthic organisms: After the project is implemented, the silt with excess organic matter at the bottom of the river will be removed, the water environment will be improved, and conditions will be created for the reconstruction of benthic animal communities. At the same time, the growth of some aquatic plants can provide a richer habitat for benthic animals, thereby increasing the diversity of benthic animals.

495. Fish: The water resources in the project river are currently unbalanced, and the fish living environment is unstable, resulting in a relatively scarce fish resource. After the project is implemented, the water resources will be relatively balanced and stable, and the plankton, which is the natural bait for fish, will gradually become abundant, creating more favorable conditions for fish survival and promoting an increase in the number of fish.

496. Animals: Most of the animal species recorded in the project evaluation area have strong mobility. After being disturbed, they will choose to temporarily flee to avoid adverse environments and migrate again after the disturbance disappears. After the construction is completed, small rodent species with a high degree of human activity will attract species at the upper trophic level of the food chain to return to the construction area, reshaping the habitat conditions of wild animals in the area. The operation period is mainly composed of personnel patrols and inspections, which have little impact on the ecological environment of the area and on animals.

497. Birds: After the project is put into operation, it will provide birds with a variety of habitats, preserve and restore natural wetland, forest, grassland and other ecosystem types, and provide suitable habitats for different types of birds. Wetlands can provide foraging and breeding places for water birds, and the increase in planted trees, sub-trees and other vegetation can provide habitats and nesting spaces for forest birds. The project creates vegetation structures of different heights and densities, including tree layers, shrub layers and herbaceous layers to meet the needs of different birds. After the project is completed and put into operation, the increase in vegetation enriches the food resources for birds, and birds can eat seeds and insects; after the project is completed, it also provides water source guarantees for birds: maintain and repair natural water bodies such as ponds, streams and small lakes to keep the

water clean. Create shallow water areas and waterside habitats to facilitate birds to drink water, bathe and forage.

498. After the wetland park is put into operation, the increase in tourists will cause some disturbance to birds: for example, the noise of tourists, outdoor activities such as running and fishing may cause birds to fly away and interfere with their normal activities. After the tourists leave, the birds can resume their normal activities, so the disturbance to the birds is not significant.

(ii) Mitigation Measures

- i) Regular ecological patrols and monitoring: Regularly patrol bird habitats and monitor the health of the habitats.
- ii) Public science displays and bird-watching guidance: Bird-watching guides and science displays are set up in parks and wetland areas to publicize bird protection knowledge to the public and guide and standardize bird-watching behavior.
- iii) In areas where birds frequently appear, ecological buffer zones and bird-watching platforms are established to guide tourists' behavior and avoid direct access to the core bird habitats. In addition, flow control mechanisms and non-visit time periods are set up in bird-watching areas to protect the normal life of birds. Management and maintenance of ecological habitat islands: Habitat islands and shallow water areas are regularly maintained to ensure that the habitat and foraging environment provided for birds is not affected.
- iv) Regularly maintain the aquatic plant population structure to prevent eutrophication of water bodies and excessive vegetation density, and protect the ecological balance of water bodies.
- v) Maintenance of bird-watching platforms and buffer zones: bird-watching platforms and buffer zones conduct regular inspection and maintenance to ensure that the facilities are stable and that tourist activities do not enter bird habitats.
- vi) Sufficient garbage recycling facilities shall be set up in the park and recycling garbage shall be conducted regularly; it is necessary to add publicity signs in key areas to encourage tourists to travel in a civilized manner and adopt environmentally friendly behaviors; and implement daily inspections and garbage cleaning to avoid secondary harm to birds from plastic bags and other hazards.
- vii) Introducing bird-friendly urban facilities: facilities such as drinking pools and food drop-off points shall be installed to support birds' daily activities and further enhance wetland biodiversity.
- viii) Low-noise warning signs and tourist guidance facilities shall be set up in the project area; silent materials and equipment shall be used to reduce noise emissions during the use of facilities; regular inspections of bird-watching platforms and fitness equipment areas shall be conducted to ensure that tourists comply with noise control requirements.
- ix) Low brightness light shall be installed in wetlands and park areas to reduce night brightness and control lighting hours; directional lighting equipment in ecologically sensitive areas shall be used to avoid unnecessary interference with bird activities.

6.2.2.2.3 Atmospheric environmental impact analysis and mitigation measures:

(i) Impact Analysis

499. No waste gas will be generated during the operation period of the wetland construction and ecological restoration project, digital platform construction and capacity building project of this project. In the drainage facility upgrading and renovation project, the renovated drainage pipelines are all buried deep underground and have no obvious impact on the local atmospheric environment after being put into use.

500. The main waste gas pollutants of the project during the operation period are a small amount of unorganized odorous gas generated during the normal operation of the pump station, and the main components include NH₃, H₂S, etc. The main reason why the pump station is prone to produce odorous

gas is that anaerobic conditions are easily formed inside the drainage pipes. The nitrogen and sulfur organic matter in the sewage will decompose into odorous substances. When the pump station equipment is started and operated, it will cause turbulence in the water flow, so that the odorous substances originally generated and dissolved in the sewage will enter the air at once, thus forming odor pollution. The grille decontamination machine in the water collection pool of the pump station needs to continuously remove garbage every day, and emits odor during the removal process. In addition, during the maintenance of the pump equipment in the pump room, high concentrations of harmful gases will instantly overflow from the water inlet pipe when the equipment is disassembled and assembled. The degree of odor is related to the sewage quality, stirring conditions and meteorological conditions. Ammonia is a colorless gas with a strong irritating odor, and the olfactory threshold is 0.037ppm; hydrogen sulfide is a colorless gas with odor and toxicity, with a value of 0.0005ppm, and has the smell of rotten eggs²⁹. The intensity of the odor changes with the change of seasonal temperature. In summer, the temperature is high and the odor is strong, while in winter, the temperature is low and the odor is weak³⁰.

Table 6-6 Main properties of odor pollutant

project	NH ₃	H ₂ S
color	none	none
At room temperature	gas	gas
odor	Strong pungent smell	Foul odor, like rotten eggs
Olfactory threshold (mg/m ³)	0.1	0.0005
Density (g/L)	0.771	1.539
Melting point	-77.7 °C	-85.5 °C
Boiling Point	-33.5 °C	-60.7 °C
proportion	0.5971, air =1.00	1.19, air = 1.00
Other properties	Easily liquefied into a colorless liquid, soluble in water and ethanol	Toxic

Source: Environmental Impact Report of Huaihua Hezhong Integrated Water Supply and Drainage Construction Project, May 2024

501. The odor control measures adopted in this project are: The design complies with the deodorization requirements in the "Outdoor Drainage Design Standard" (GB 50014-2021). The main body of the sewage pumping station is underground, and a cover is installed on the grid. At the same time, deodorization facilities are installed, and biological deodorization technology is used for deodorization.

502. Since the design scheme, equipment and technology of the project pump station are basically the same, and the environmental sensitive points around Zhuanglin Pump Station are mostly residential buildings in the community, with the closest straight-line distance of 25 meters, Zhuanglin Pump Station was selected as an example for atmospheric environmental impact prediction. Due to the same terrain and wind speed conditions, the prediction results of Zhuanglin Pump Station can be used as an analogy to predict and evaluate the atmospheric environmental impact during the operation period of this project.

503. This evaluation uses NH₃ and H₂S as characteristic odor pollutants of the proposed project to evaluate the environmental impact of the odor of the sewage treatment plant. According to the design plan, the underground water collection tank of Zhuanglin Pump Station is built together with the pump room, with an area of 140.76m². According to "Odor Evaluation and Treatment Countermeasures of Sewage Pump Station" (Environmental Engineering 2012 Volume 30 Supplement), the odor source strength per unit area of sewage structures is NH₃ 0.52mg/s · m² and H₂S 0.0011 mg/s · m²³¹. After calculation, the odor source strength of this project is NH₃ 73.20mg/s and H₂S 0.15mg/s. According to the FSR, the construction location of the pump station water collection tank is underground, which effectively seals the odor gas. In addition, it is equipped with a ventilation system and adopts biological deodorization technology. The deodorization efficiency is calculated as 75%³². A small amount of

²⁹ Environmental Impact Statement of the Xuancheng Lingyang Road Sewage Lifting Pump Station and Shuangta Road (Temporary) Sewage Lifting Pump Station Project, May 2016

³⁰ Environmental Impact Statement for the Integrated Water Supply and Drainage Construction Project in Hezhong, Huaihua City, May 2024

³¹ Meng Lihong, Yang Erhui, Wu Bingui, Zhang Min. Odor evaluation and control measures for sewage pumping stations[J]. Environmental Engineering, 2012, 30(S2): 70-72150

³² Environmental Impact Statement for the Integrated Water Supply and Drainage Construction Project in

overflow odorous waste gas is discharged unorganized. After treatment, the emissions of odor pollutants NH₃ and H₂S from the Nanqian Pumping Station were 18.30 mg/s for NH₃ and 0.039 mg/s for H₂S, respectively.

Table 6-7 List of Odor Pollutant Emissions from Zhuanglin Pump Station during Operation Period

Pumping station name	Area of surface source (m ²)	Deodorization technology and deodorization efficiency	Odor source strength (mg/s)		Pollutant emissions (mg/s)	
			NH ₃	H ₂ S	NH ₃	H ₂ S
Zhuanglin Pumping Station	140.76	Biological deodorization method; 75%	73.20	0.15	18.30	0.039

Source: ESIA Unit, September 2024

504. The nearest residential area to Zhuanglin Pumping Station is Xianfeng Community (25m). The odor emissions from the sewage pumping station are predicted based on the estimation model AERSCREEN recommended in the *Technical Guidelines for Environmental Impact Assessment - Atmospheric Environment (HJ 2.2-2018)*. The prediction results are shown in the table below.

Table 6-8 Prediction of Ground Concentration of Odor in Sewage Pumping Stations during Hour

Distance from source (m)	NH ₃	H ₂ S
	1 hour concentration (mg/m ³)	1 hour concentration (mg/m ³)
10	2.23x10 ⁻¹	4.76 x10 ⁻⁴
25	4.04 x10 ⁻²	8.60 x10 ⁻⁵
50	1.16 x10 ⁻²	2.47 x10 ⁻⁵
75	5.68 x10 ⁻³	1.21 x10 ⁻⁵
100	3.44 x10 ⁻³	7.33 x10 ⁻⁶
125	2.34 x10 ⁻³	4.99 x10 ⁻⁶
150	1.71 x10 ⁻³	3.65 x10 ⁻⁶
175	1.32 x10 ⁻³	2.81 x10 ⁻⁶
200	1.08 x10 ⁻³	2.31 x10 ⁻⁶

Source: ESIA Unit, September 2024

505. According to the calculation results of the atmospheric guideline estimation model, the concentrations of NH₃ and H₂S generated by the Zhuanglin Pumping Station of this project at the plant boundary meet the limits of the second-level standard for new, modified and expanded construction in Table 1 of the *"Emission Standards for Odor Pollutants" (GB14554-93)* (i.e. 1.5 mg/m³ for NH₃ and 0.06 mg/m³ for H₂S). The prediction results show that the one-hour concentration of the odor pollutants NH₃ and H₂S of the Zhuanglin Pumping Station is less than the limits of the second-level standard in Table 1 of the *"Emission Standards for Odor Pollutants" (GB14554-93)* at 25 meters from the source. Therefore, the unorganized emission of odorous gases from the Zhuanglin Pumping Station will not affect the residential area at a straight-line distance of 25 meters.

506. Through analogy analysis, the odors such as hydrogen sulfide and ammonia pollutants generated during the operation period of the newly built or renovated pump station project of this project will not affect the sensitive points of the surrounding environment.

507. In addition, the project pump station will also produce odorous gas in the event of an accident, such as pump station and pipeline failure, shutdown for maintenance, or power outage that will cause sewage overflow. This situation is random, accidental, and unpredictable. As the fault is eliminated, the odorous gas generated in the accident will also end, and its impact is short-lived.

508. In summary, the odor generated by the sewage pumping station during operation has little impact on the surrounding area.

(ii) Mitigation Measure

509. When designing drainage projects, it is advisable to use sewage and sludge treatment processes and equipment that emit less odor, and to control the source of odor through measures such as isolating

the odor source, preventing corrosion, and cleaning equipment;

510. Strengthen management: Strengthen management during operation. The screen residue and sand should be removed in time at the water inlet section, the screen should be cleaned regularly, and the debris removed by the coarse screen cleaner should be cleaned and removed in time to prevent the water-containing debris from rotting and producing odor;

511. When the odor concentration at the sewage plant boundary meets the emission requirements, plant liquid can be sprayed in non-enclosed operation areas to effectively remove odor and alleviate the impact of odor;

512. Strengthen greening: Greening projects are very important for improving the environmental quality of sewage treatment facility areas. Flowers, plants and trees should be widely planted in the project area, and a green belt of a certain width should be planted at the edge of the factory boundary. Tree species that can effectively absorb odors should be selected to reduce the impact of odor pollution;

513. Construction units should strengthen equipment and pipeline management, and strengthen on-site inspections, checks and maintenance to reduce the occurrence of accidents;

514. Develop a comprehensive emergency response plan for unexpected accidents and strengthen drills so that when an accident occurs, we can respond and rescue in a timely manner and shorten the impact time.

6.2.2.2.4 Acoustic environmental impact analysis and mitigation measures:

(i) Impact Analysis

515. After the project is completed and put into operation, the main noise sources are pump station operation noise, low-frequency noise from the power distribution room, and social life noise. During the operation period of the wetland construction project, it provides citizens with a place for leisure, entertainment and sports. The social life noise source intensity generated by citizens during leisure and entertainment is 50-65dB(A), which has little impact on the surrounding environment.

516. The noise of pump station operation is mainly caused by equipment vibration, motor noise, pipeline resonance and other reasons. The pump station of this project is placed in the pump room, and the noise value of a single unit is about 80dB(A)-90dB(A), and the noise value of the power distribution room is relatively small. According to the prediction results of similar projects, without taking any preventive measures, the noise contribution value 10m away from the pump room is about 58dB(A), which meets the standard during the day 20. The project plans to take noise reduction measures such as shock absorption and sound insulation for the main noise-generating equipment, and carry out greening around the factory area to reduce noise. The noise of this project can meet the requirements of the Class 2 standard limit of the "Environmental Noise Emission Standards for Industrial Enterprises" (GB12348-2008), and has little impact on the surrounding residential areas.

(ii) Mitigation Measures

- i) Give priority to mechanical equipment with lower noise intensity.
- ii) Water pumps and other continuous noise equipment are placed in the factory, and sound insulation materials are installed on the inner walls of the room; equipment is installed with vibration reduction pads, shock-absorbing springs or anti-vibration pads and other facilities. The blower is located in the fan room, and the foundation is shock-absorbing and the factory sound insulation is done well.
- iii) Strengthen the maintenance of processing equipment and oil the fan bearings and other parts in time. Operators of high-noise mechanical equipment should be equipped with noise-proof labor protection and arrange the operation time reasonably.
- iv) In pipeline design, attention should be paid to shock and impact prevention to reduce falling and vibration noise. Air ducts and fluid transportation should be improved to improve their

²⁰ Environmental Impact Statement for the Construction Project of Sewage Pipeline Network and Lifting Pump Station in Xiangyang Hebei Industrial Concentration Zone, Xiaoguanzhuang Town, Baoying County, April 2017

smoothness and reduce aerodynamic noise.

- v) A combination of trees and shrubs will be planted around the pump station to further reduce the impact of noise generated during the operation of the project on surrounding residents.

6.2.2.2.5 Soil environmental impact analysis and mitigation measures

517. The project has no high-pollution industries, and has no obvious direct impact on the soil after operation. The operation of the project is conducive to the connection of water systems, the restoration of wetland ecology, and the exchange of water and nutrients in the soil. The salinization intensity of the soil in the area will not be aggravated by the construction of the project. At the same time, there is no sewage generation and discharge during the operation of the project. After the completion of the project, the existing water system pattern in each area of the project will remain unchanged, the hydrological situation will basically not change, the groundwater level will not change, and the soil pH value will not change. The pipeline project will not have adverse effects on the soil environment during normal operation. When the pipeline is broken due to non-compliant operation or accidents, the sewage in the deep underground pipeline will overflow, which will pollute the surrounding soil: sewage will destroy the soil structure, and a large amount of organic matter and microorganisms in the sewage will affect the physical properties and structure of the soil, resulting in increased soil clay, easy to form lumps, and poor soil permeability; in addition, sewage overflow will also cause the risk of soil pollution. When some harmful substances in sewage, such as heavy metals, exceed a certain concentration, they will pollute the soil, and in severe cases, the soil will lose its fertility.

518. During the operation period, equipment and pipeline management should be strengthened, and on-site inspections, checks and maintenance should be intensified to reduce the occurrence of accidents and avoid pollution of the surrounding soil environment due to sewage overflow accidents.

6.2.2.2.6 Solid waste impact analysis and mitigation measures

(i) Impact Analysis

519. Solid waste during the operation period mainly includes food waste (fruit cores, fruit peels, and meal leftovers) generated by tourists, food bags, paper scraps, etc., domestic waste from pump station staff, and screen residues from pump station removal. Floating objects in the river during the operation period mainly include domestic waste accidentally dropped into the water by tourists, leaves from riverside greening, and remnants of dead aquatic plants and fish.

520. The waste filtered by the screen is not dehydrated or crushed in the station, but directly collected and temporarily stored. After being disinfected with lime, it is handed over to the sanitation department for unified transportation and treatment. The screen residue is cleaned up in time and will not cause secondary pollution problems, so its impact on the environment is also relatively small.

521. Domestic garbage and salvaged floating objects are collected and transported to nearby garbage transfer stations for unified treatment. The design sets up classified garbage bins in each functional area of the project area and equips garbage removal equipment, so the solid waste in the wetland park can be properly disposed of, with little impact on the environment. The pump station is equipped with 1-2 staff members, and the amount of garbage generated is small. Domestic garbage is piled up in a centralized manner, and the local sanitation department is entrusted to timely remove and properly handle it, so that it can be cleared on a daily basis without causing secondary pollution problems.

522. A certain amount of waste lubricating oil will be generated during the maintenance of the project's production equipment (such as water pumps, sludge pumps, etc.), with a production volume of about 0.005t/a. According to the National List of Hazardous Wastes (2021 edition), waste lubricating oil belongs to "900-217-08 Waste lubricating oil generated during the lubrication of mechanical equipment using industrial gear oil" in "HW08 Waste mineral oil and waste containing mineral oil". It is temporarily stored in barrels in the hazardous waste temporary storage room and regularly entrusted to qualified units for disposal.

523. In summary, this project will do a good job in the classified collection, management and disposal of solid waste after operation. The solid waste generated during the project operation period can be effectively treated and disposed of. The solid waste generated by this project will not have any impact on the surrounding solid waste environment.

(ii) Mitigation Measures

524. In terms of design, classified garbage bins are set up in each functional area of the project area, and garbage removal equipment is provided, and the local sanitation department will promptly remove and dispose of the garbage;

525. General garbage must be disposed of in accordance with the regulations of the sanitation, environmental protection, urban management and other relevant departments, and solid waste must be transported to designated locations in a timely manner. Garbage must not be scattered, piled or transferred along the road;

526. Domestic waste is collected and transported to waste treatment stations. Domestic waste transportation is basically containerized and sealed.

527. The pump station management unit should entrust relevant units to regularly dredge the pipelines, remove silt and slag. Solid waste and sludge blocked by the grilles should be directly transported by professional transport vehicles of the sanitation department, and should be transported immediately after cleaning without temporary storage.

528. Cleaning staff in the wetland park clean public areas and remove fruit peels and paper scraps in a timely manner; regularly trim the branches and leaves of green plants and remove dead branches and leaves in a timely manner to prevent dead branches and leaves from falling into the river and affecting the water environment; the sanitation department regularly removes and disposes of green solid waste;

529. Strengthen the management of the wetland park in the project, strengthen environmental education for citizens and tourists, prohibit littering, and keep the working and living environment clean;

530. Hazardous wastes such as discarded lubricating oil must not be landfilled or discarded without authorization, and must not be mixed with domestic waste for transportation; a temporary storage room for hazardous wastes should be established, and after centralized collection, they should be sent to qualified hazardous waste treatment units for treatment to avoid environmental pollution.

6.3 Climate Change Risk Assessment

531. The purpose of climate change risk assessment is to ensure that project facilities can operate continuously and stably in the face of climate change challenges. Climate change risk analysis first needs to identify potential risks based on historical observation data and future climate change forecasts, such as increased energy demand due to rising temperatures and the impact of extreme weather events on communication systems. Based on the possible risks, develop corresponding adaptation strategies to enhance the resilience of facilities and reduce greenhouse gas emissions. Detailed climate change risk assessments can be found in separate climate risk and vulnerability assessment reports.

6.3.1 Climate Risk Assessment

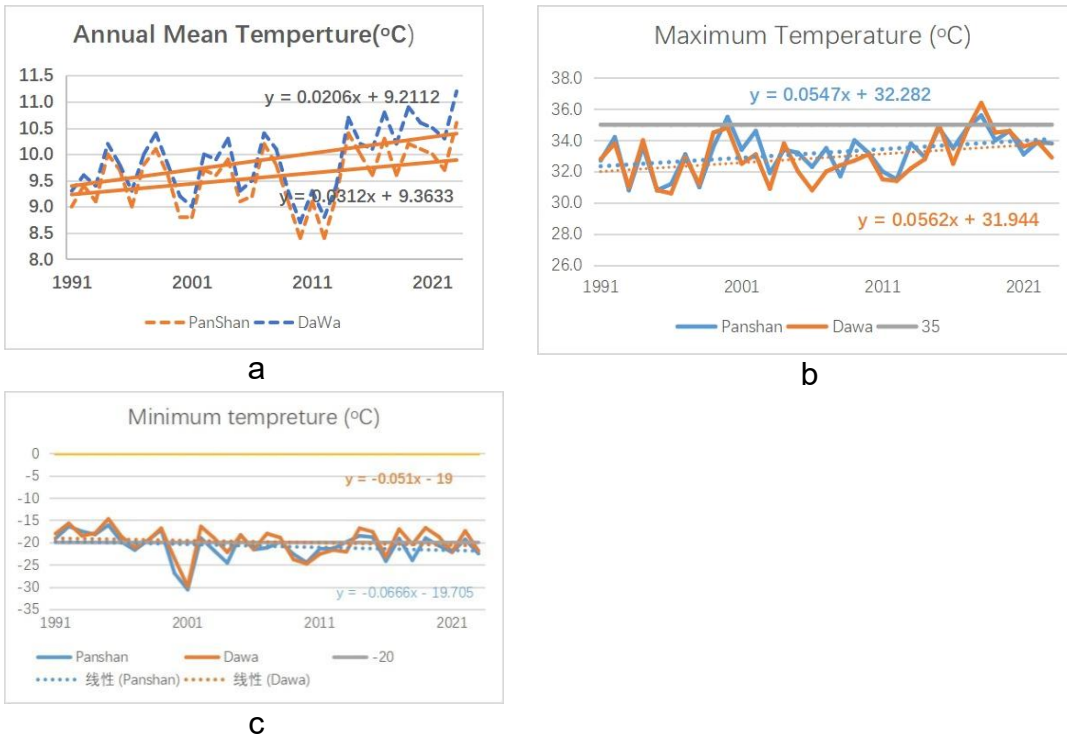
532. The data of observed historical climate change trends were referred to two meteorological station, which are Panshan station and Dawa station.

- i) Annual average temperature, maximum temperature, minimum temperature

533. The climate in Panjin City is temperate, located in a warm temperate continental semi-humid monsoon climate zone. The annual mean temperature is 9.56 °C for PanShan and 9.89 °C for DaWa. July is the warmest month while January is the coldest. There are consistent increasing trends in the annual mean temperature at these two stations from 1991 to 2023, increased by 0.2 °C to 0.3 °C every ten years. Panshan and Dawa stations recorded peak temperatures of 35.6°C and 36.5°C from 1991 to 2023, respectively; Conversely, while the lowest temperatures on record stand at -30.6°C and -29.9°C, respectively. Notably, the annual maximum temperature demonstrates an upward trend, the annual minimum temperature shows a slight decrease over time. Drought and cold waves are the major meteorological disasters in the Panjin City.

534. The annual average temperature shows consistent increasing trends, the hot day (HD) is projected to rise significantly, while the cold day (CD) will moderately decrease. By 2050, the projected annual mean temperature changes increases +2.03°C under SSP245 and +3.25°C for Dawa under SSP585. The projected annual mean temperature changes in 2090s increases higher to +2.57°C under SSP245 and +5.82°C for Dawa under SSP585. By 2050, the HD is projected to rise moderately, +0.9 days/yr and

the annual CD will moderately decrease by 2.35 days under SSP245, and the HD will rise more significantly, +1.67 days/yr, and the CD will decrease by 2.70 days under SSP585. By 2090, the annual HD is anticipated to surge even more dramatically, with increases of +2.3 days/yr and the CD will decrease by 3.08 days under SSP245; the annual HD will increase +22.53 days/yr and the annual CD will decrease by 3.15 days under SSP585.



Source: Project Climate Risk and Vulnerability Assessment Report, November 2024

Figure 6-14(a) Annual Mean Temperature Change Trends (1991 - 2023) of the Two Stations; (b) Change trend of Annual maximum temperature of at the project region; (c) Change trend of Annual minimum temperature of at the project region

Table 6-9 Estimated changes in annual average temperature compared with 1995-2014 (°C)

2041 ~ 2060	
SSP245 +2.03 (+1.11~+3.25)	SSP585 +3.25 (+1.76~+4.90)
2081 ~ 2100	
+2.57 (+1.44~+3.91)	+5.82 (+3.30~+8.40)

Note: SSP = Shared Socioeconomic Pathway; uncertainty ranges in brackets

Source: Climate Risk and Vulnerability Assessment Report, September 2024

Table 6-10 Projected Changes in the Hot Days (Temperature > 35°C) (days/yr) and in the Cold Days (Temperature < -20°C) at Dawa Station

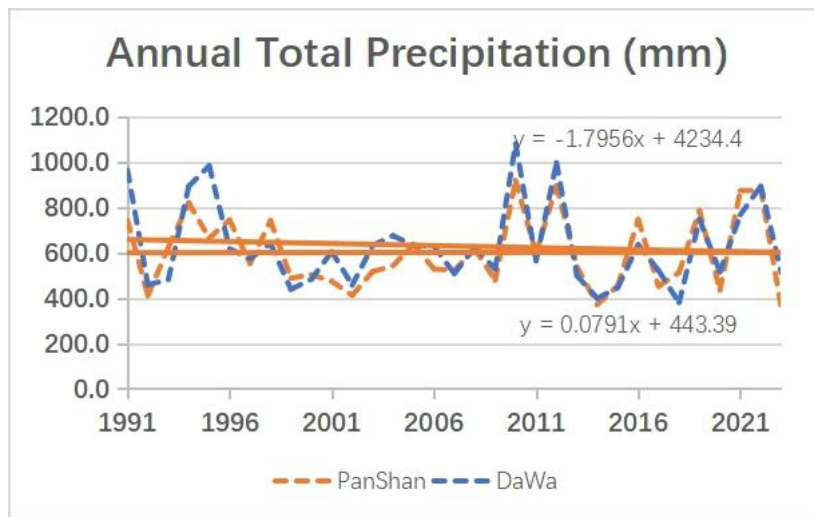
	2041-2060	
	SSP245	SSP585
Hot days	+0.9 (-0.1~+8.4)	+1.67 (0.0~+9.95)
Cold days	-2.35 (-5.45~-0.70)	-2.70 (-5.70~-0.60)

	2081-2100	
Hot days	+2.3	+22.53
	(-0.15~+14.65)	(+1.65~+67.35)
Cold days	-3.08	-3.15
	(-5.70~-0.70)	(-5.70~-0.90)

Source: Project Climate Risk and Vulnerability Assessment Report, November 2024

ii) Annual average precipitation

535. The annual average precipitation is 602.16 mm for PanShan and 630.73 mm for DaWa. July and August are the wettest months whilst winter (December, January and February) is the dry season in the whole year. No clear change trends for the two stations during 1991-2023. The annual average precipitation shows an upward trend during the future scenarios of climate change. Annual precipitation in 2050s is projected to change by increasing +5.95% and +7.59 % under climate change scenarios of SSP245 and SSP585 respectively. Annual precipitation in 2090s is also projected to change by increasing +8.29% under SSP245 and +23.21% under SSP585, respectively.



Source: Project Climate Risk and Vulnerability Assessment Report, November 2024

Figure 6- 15 Annual Precipitation Change Trends (1991 - 2023) of the Two Stations

Table 6- 11 Estimated median changes in annual precipitation in regions relative to 1995-2014

2041 ~ 2060	
SSP245	SSP585
+5.95%	+7.59%
(-7.91~+38.76)%	(-4.74~+33.57)%
2081 ~ 2100	
+8.29%	+23.21%
(-3.64~+51.75)%	(-4.77 ~+74.75)%

Note: SSP = Shared Socioeconomic Pathway; brackets indicate uncertainty ranges

Source: Climate Risk and Vulnerability Assessment Report, November 2024

iii) Extreme precipitation events

536. The historical maximum daily precipitations at Panshan and Dawa during the 60 years observed period are 231.6 mm and 239.2 mm respectively. The 20-year Average Recurrence Interval (ARI)

precipitation of Panshan is 227.97 mm, while the 20-year ARI precipitation in Dawa is 228.83 mm. The 20-year ARI daily maximum precipitations in 2050s increase by +23.39% for Dawa station under SSP245 and by +9.97% under SSP585. The 20-year ARI daily maximum precipitation in 2090s will dramatically increase by +16.23% for Dawa station under SSP245 and by +33.45% under SSP585. Specific N-year ARI precipitation analysis sees the separate Climate Risk and Vulnerability Assessment Report (CRVA). The future predictions show that the frequency and intensity of extreme precipitation could be increased.

Table 6- 12 Median changes in daily precipitation in Dawa with a return period of 5, 10, 20 and 30 years based on 21 models (compared with 1995-2014)

N-year	2041 ~ 2060	
	SSP245	SSP585
5 years	+4.27% (-18.06~+47.01)%	+9.07% (-18.31~+42.21) %
10 years	+ 7.47% (-18.73~+107.82 %	+6.33% (-23.48~+91.26 %
20 years	+23.39% (-31.58~+309.37) %	+9.97 % (-28.24~ + 164.65)%
30 years	31.70% (-38.61~+525.63)%	+16.8% (-30.86~+223.14)%
	2081 ~ 2100	
5 years	+14.88% (-19.11~+64.69)%	+25.97% (-18.42~+108.44)%
10 years	+15.02% (-19.44~+88.72)%	+29.56% (-26.74~+83.09)%
20 years	+16.23% (-28.55~+124.99)%	+33.45% (-33.94~+175.49)%
30 years	+15.00% (-33.24~+162.49)%	+33.99% (-37.76~268.21)%

Source: Climate Risk and Vulnerability Assessment Report, September 2024

537. Specific climate change analysis sees the separate CRVA. According to the results of the climate change assessment: the project area may face climate risks including i) the annual mean temperature will consistently increase; ii) the annual mean precipitation may increase; iii) the amount of hot days will increase significantly; while the amount of cold days will be potential to decrease; iv) the frequency and intensity of extreme precipitation events may increase; v) the frequency of drought is potential to decrease but with an increased intense.

6.3.2 Climate Risk Adaption

Table 6- 13 Project Tasks and Climate Vulnerability, Adaptation Assessment

Project activity	Climate Vulnerability	Adaptation Options
Subproject 1: Wetland Construction and Ecological Restoration		
> Water System Interconnection	For open channels: Increased flood risks of <ul style="list-style-type: none"> Heavy rainfall may lead to inadequate drainage capacity of newly built open channels, resulting in overflow that causes waterlogging damage to nearby roads, buildings and other structures.; Result in damage and collapse of newly constructed open channels; Lead to water pollution and affect water supply safety; For underground drainage channels: Increased flood risks of: <ul style="list-style-type: none"> Heavy rainfall increase the drainage pressure on underground channels, potentially exceeding their 	<ul style="list-style-type: none"> Fully consider the potential increase in future rainstorms (20%) when designing the drainage capacity and flood control standards of open channels, underground stormwater channels and roads and bridges; Establish a monitoring and early warning system for open channels and underground channels to monitor parameters such as water level and flow rate in real-time, enabling timely warnings; and Formulate comprehensive emergency response plans and mechanisms for them.

Chapter 6 Environmental Impact and Risk Analysis and Mitigation Measures

Project activity	Climate Vulnerability	Adaptation Options
	<p>design capacity;</p> <ul style="list-style-type: none"> • Debris, leaves and trash carried by rainwater may clog the channels, reducing the drainage efficiency and threatening water quality; • Excessive water flow and pressure can damage the the structures of channels; • Overflowing stormwater channels may flood nearby infrastructure; <p>For roads and bridges: Increased flood risks of:</p> <ul style="list-style-type: none"> • Heavy rainfall may cause flooding on roads and bridges; • Cause structural damage or even collapse of road and bridges 	
<p>➤ Wetland Conservation</p>	<p>Increased flood risks of</p> <ul style="list-style-type: none"> • Cause significant soil erosion in wetlands. • Deteriorate water quality; • Lead to a decline in biodiversity; • Reduce ecosystem functions; <p>Increased drought risks of</p> <ul style="list-style-type: none"> • Reduce water availability; • Damage the soil structure and reduce its productivity • Cause a decline in biodiversity 	<ul style="list-style-type: none"> • Implement robust wetland protection policies and laws to ensure wetlands are legally safeguarded and managed effectively; • Construct flood control structures like levees and gates around wetlands; • Establish a comprehensive monitoring network and early warning system to forecast heavy rainstorms, enabling timely responses; • Rehabilitate damaged wetlands, promote biodiversity, and enhance wetland resilience against storm impacts;
<p>➤ Ecological Shoreline</p>	<p>Increased flood risks of:</p> <ul style="list-style-type: none"> • Intense rainfalls may cause flooding, damaging river flood protection infrastructure and surrounding farms and buildings; • Heavy rainfalls can lead to increased water flow, causing erosion of the shoreline; • Rainstorms can wash large amounts of sediment and pollutants into waterbodies, clouding the water and degrading water quality; 	<ul style="list-style-type: none"> • Examine the adequacy of design height of embankment against a 20% increment of flood height; Adjust the design value if capacity is not adequate. • Consider the staged adaptation in the future, avoid non-retrofitable design, and preserve the possible future adaptation measure implementation in design; • Establish monitoring networks an early warning systems to track extreme weathers; • Set up a disaster emergency response system with sufficient disaster emergency supplies (e.g., sandbags).
<p>➤ Urban Ecological Green Island Construction</p>	<p>Increased flood risks of</p> <ul style="list-style-type: none"> • cause significant soil erosion and wash away topsoil and nutrient essential for plant growth; • Cause flooding, submerging green spaces and potentially damaging vegetation; • Standing water and humid conditions created by heavy rainfall can favor the growth and spread of plant diseases and pest; • Lead to a decline in biodiversity; • Reduce ecosystem functions; <p>Increased drought risks of</p> <ul style="list-style-type: none"> • Reduce water availability for plants; • Damage the soil structure and reduce its productivity; • Cause a decline in biodiversity; 	<ul style="list-style-type: none"> • Upgrade and maintain drainage infrastructure to reduce waterlogging and flooding in green islands; • Adopt rainwater conservation and interception measures; • Make regular and emergency irrigation measures in grass spaces during dry periods; • Suggest dry resistance grass& tree species in tree and grass planting; • Implement pests and diseases control measures; • Establish monitoring networks an early warning systems to track extreme weathers; • Set up a disaster emergency response system;
<p>Subproject 2: Upgrading and Renovation of Urban Drainage Facilities Subproject</p>		
<p>➤ Rainwater pipe</p>	<p>Increased flood risks of</p>	<ul style="list-style-type: none"> • Establish separate storm water and

Project activity	Climate Vulnerability	Adaptation Options
network renovation and rainwater and sewage separation	<ul style="list-style-type: none"> • The climate risks of those rainwater and sewage pipelines are all related to heavy rainfalls and waterlogging in the city during rainy season; • Increases in rainfall intensity will cause risks for sewage pipelines being flooded; • The design of rainwater pipelines may not meet the needs of future drainage requirement and causes waterlogging; • High velocity water flow can erode soil and damage drainage infrastructure; 	wastewater drainage system to improve capacity of treating wastewater and collecting rain water; <ul style="list-style-type: none"> • The design of stormwater pipe diameters should consider future increases in stormwater; • Employ sponge city concept to reduce runoff and promote infiltration; • Consider recycling and reusing sewage to alleviate water pressure during dry seasons. • Establish a regular cleaning mechanism to maintain consistent sewage treatment capacity; • Set up a disaster emergency response system; • Set up a smart drainage system; • Select appropriate materials for resisting degradation and damage from flood;
➤ Equipment upgrading	Increased flood risks of <ul style="list-style-type: none"> • Climate change may enhance flood severity, which may lead to inadequate capacity of the drainage pumps; • Flooding can damage electrical systems and cause power outages at pump stations 	<ul style="list-style-type: none"> • Regularly maintain and upgrade pump station equipment; • Implement preventive measures against water ingress; • Ensure the reliability of backup system;
Subproject 3: Digital Drainage System Platform Construction Subproject		
➤	<ul style="list-style-type: none"> • Flooding can damage electrical components, control systems, and mechanical parts; • 	<ul style="list-style-type: none"> • Implement preventive measures against water ingress; • Ensure the reliability of backup system; • Smart digital platforms can help mitigate extreme climate challenges by providing real-time monitoring, intelligent resource allocation, dynamic decision-making support, and enhanced public communication;
Subproject 4: Capacity Building		
➤	<ul style="list-style-type: none"> • Heavy rainstorms often inflict impacts and damage on urban infrastructure, including drainage systems, transportation networks, and power systems; • The projected increase in the frequency of heavy rainstorms and droughts in the future poses greater challenges for both governments and the public in their efforts to cope with extreme weather events. 	<ul style="list-style-type: none"> • Establish an early warning system for extreme events such as floods and droughts, such as a smart water management system; • Develop post disaster recovery plan; • Establish the policies and regulations for climate adaptation and carbon neutrality. • Training and promotion: Raise public awareness of climate risks and responses to climate change; enhance public awareness of low-carbon living, including the use of clean energy, ecological protection, waste utilization, and a circular economy.

Source: Project CRVA, November 2024

538. Specific climate change adaptation measures, mitigation measures and climate financing estimate see the separate CRVA.

6.4 Carbon Analysis

6.4.1 Carbon emission analysis during construction period

1. Carbon emission reduction analysis

539. The carbon emissions caused by electricity consumption are calculated by multiplying the total electricity consumption with the electricity emission factor of the region, as follows:

$$CE_d = E_d \cdot EF_d$$

Where CE_d is the carbon emission intensity of electricity consumption, $kgCO_2\text{-eq}/m^3$;

E_d ——total electricity consumption, kWh;

EF_d ——Electricity emission factor for the region, kgCO₂-eq/kWh.

540. Equipment renewal to save electricity: This project will update the old equipment of 42 drainage pumping stations in Panjin City through the drainage pumping station equipment renewal project in Xinglongtai District, Shuangtaizi District and Dawa District, to achieve high efficiency, energy saving and stable operation of the equipment.

541. Solar lighting to save electricity: This project is the lighting project, which requires 749 sets of solar street lights. Each solar street light is a relatively independent system. During the construction, there is no need to lay cables or dig up the road surface, thus saving a lot of manpower and material resources. A street light is on for 6 hours a day and consumes about 2kW·h of electricity.

Table 6-14 Project electricity saving analysis

No.	Project Type	Annual energy consumption	unit
1	Equipment update to save electricity	324.85	10,000 kW·h /a
2	Solar lighting to save electricity	54.76	10,000 kW·h /a
	total	379.61	10,000 kW·h /a

542. According to the electricity emission factors for China released by the Ministry of Ecology and Environment of PRC in 2020:

Table 6-15 Electricity emission factors in China (kgCO₂-eq/kWh)

Area	Emission factor (kgCO ₂ -eq/kWh)
North China Regional Power Grid	0.9419
Northeast Regional Power Grid	1.0826
East China Regional Power Grid	0.7921
Central China Regional Power Grid	0.8587
Northwest Regional Grid	0.8922
Southern Regional Grid	0.8402

543. After the project will be implemented, the electricity consumption will be saved by about 3.7961 million kW·h /a through equipment renewal and other methods, which means the carbon emission will be reduced by about 4109.6 t CO₂-eq/a.

2. Carbon Sequestration Capacity Analysis

Table 6-16 Comparison of CO₂ fixation per unit planting area per year under different planting methods

Planting method	CO ₂ Fixed amount (kg CO ₂ /m ² a)
Densely planted mixed planting area of large and small trees, shrubs, flowers and grasses (average planting distance of trees) <3.0m, soil depth>1.0m	27.5
Large and small trees densely planted mixed planting area (average planting distance) <3.0m, soil depth>0.9m	22.5
Large deciduous trees (soil depth > 1.0m)	20.2
Deciduous small trees, coniferous trees or sparse-leaved trees (soil depth > 1.0m)	14.3
Small palms (soil depth > 1.0m)	10.25
Densely planted shrubs (about 1.3m high, soil depth >0.5m)	10.95

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Densely planted shrubs (about 0.9m high, soil depth >0.5m)	8.15
Densely planted shrubs (about 0.45m high, soil depth >0.5m)	5.13
Perennial vines (calculated based on three-dimensional climbing area, soil depth > 0.5m)	2.58
Tall grass flower beds or tall-stemmed weed fields (about 1.0m high, soil depth >0.3m)	1.15
Annual vines, low grass flower beds or low-stemmed weeds (about 0.25m high, soil depth > 0.3m)	0.34

544. This project has a total of 10 subprojects related to greening and greenspaces. The specific projects and greening areas are shown in the following table:

Table 6-17 Greening and greenspaces projects

No.	project	Renovation area (m ²)	Greening replanting area (m ²)	Area of trees (m ²)	Shrub area (m ²)	Ground cover plants (m ²)	Aquatic plants (m ²)
1	Yangjia Canal Wetland Park Construction Project	95,000	38,700	62,300	18,000	12,000	18,000
2	Youyi Street Water System Connection Project	112,500	49,560	5,280	14,500	33,740	
3	Liaohe Sluice Park Ecological Restoration and Improvement Project	115,000	71,575	20,700	6,300	5,000	
4	Liaohe Forest of Steles Park Wetland Ecological Restoration and Improvement Project	9,100	5,450	4,050	1,400	5,200	5,200
5	Ecological wetland on the east side of Yangjia Canal	136,000	59,200	16,800	24,000	31,000	18,000
6	Xiaoqinghe River Ecological Wetland	37,500	19,100	19,200	9,000	6,000	7,500
7	Hundred-acre lotus pond ecological restoration project	1,200,000	12,750	18,500	4,000	6,000	15,000
8	Yitonghe River Ecological Restoration and Improvement Project	26,300	18,324	20,670	1,500	12,530	
9	Greening project on both sides of Goupan Canal	48,400	42,300	29,700	15,000	23,000	
10	Urban ecological green island construction project					133,028	
total		1,779,800	316,959	197,200	93,700	267,498	63,700

545. Ecological carbon sequestration is that carbon dioxide is transformed into organic matter through plant photosynthesis and stores it in plants or in the soil. Plants absorb CO₂ through photosynthesis and convert it into organic matter such as glucose, which is eventually fixed in the plant body or in the soil, thereby reducing the CO₂ concentration in the atmosphere. As the main body of terrestrial ecosystems, forests have strong carbon capture and storage capabilities and are one of the main ways of biological carbon fixation.

546. In summary, the plant carbon fixation capacity of this project is about 4480.82 t CO₂/ a.

6.4.2 Project Carbon Emission Control Plan

1. Rainwater system emission reduction path

(i) Source reduction

547. The core of source reduction is to build an urban drainage system that is compatible with nature and reduce the amount of rainwater through decentralized facilities. Reducing the total amount of rainwater runoff can effectively reduce the carbon emissions of rainwater system operation and maintenance. Through source reduction measures, the annual runoff control rate can generally be increased by about 60% and the rainwater discharge can be reduced by more than 60%.

(ii) Green infrastructure

548. Using green facilities to replace reinforced concrete facilities in the planning and construction of urban rainwater systems can significantly reduce greenhouse gas emissions from rainwater system planning and construction. Under the condition of achieving the same rainwater control rate, the total carbon emission intensity of reinforced concrete rainwater storage tank construction is 513.32kgCO₂-eq/m³ (calculated according to water storage capacity), while the carbon emission intensity of most green facility planning and construction is below 200kgCO₂-eq/m³, or even below 100kgCO₂-eq/m², with an emission reduction rate of more than 80%. In the planning and construction, the carbon emissions of concrete lined ditch construction are about 50% of those of reinforced concrete pipes, and the carbon emissions of grass-planted ditch construction are almost zero.

549. Green infrastructure can reduce the use of non-renewable materials and the amount of earthwork during construction. Under normal maintenance, it has a longer service life than gray facilities. During the asset replacement and demolition stage, only a small number of facilities need to be disposed of off-site, which greatly reduces carbon emissions during the asset replacement and demolition stage. In addition, because water cannot infiltrate gray facilities, gray facilities tend to be built larger and consume more building materials with higher emission coefficients under the condition of achieving the same rainwater control rate. At the same time, plants in green facilities can serve as carbon sinks.

550. Therefore, under the premise of meeting the design requirements, green infrastructure can be considered to replace gray facilities, and ecological ditches can be used to replace gray open channels.

(iii) Gravity flow channel

551. When designing rainwater pipes, the minimum slope and minimum flow rate must be guaranteed at the same time. At the same time, the pipes are laid under the influence of factors such as the local groundwater level, the thickness of the pipe cover, the distance from the discharge point, and the water volume in the pipe service area. The design of the drainage pipe system should be based on gravity flow, with no or few lifting pump stations.

552. Carbon emissions from the rainwater pipe system mainly come from the construction of pipe network pump stations and the carbon emissions caused by pump station lifting. The use of pressure flow consumes a lot of electricity in the operation of the pump station, resulting in indirect carbon emissions. At the same time, the indirect carbon emissions generated by the additional construction of pump stations and houses are relatively large. From the perspective of rainwater control, the storm runoff is large, and the scale of pump station construction and investment also increase accordingly. In some areas, the required operating time of rainwater pump stations is not long throughout the year, and the utilization rate is low, which is not economical.

(iv) Rainwater and sewage separation drainage system

553. The combined sewer system is a drainage system that mixes domestic sewage, industrial wastewater and rainwater in the same channel and discharges them. The diversion system discharges domestic sewage, industrial wastewater and rainwater in two or more independent pipes. During rainfall, rainwater, domestic sewage and other materials are mixed and enter the combined sewer system. When entering green facilities such as rainwater wetlands, the high concentration of pollutants and poor water quality of the influent increase the treatment load of the facilities. In addition, the microorganisms and more organic matter in the mixed water also increase the carbon emissions of rainwater wetlands. This problem can be avoided if a diversion system is used to ensure that the rainwater entering the rainwater facilities is low in pollutant concentration and relatively clean in quality. In addition, when the rainwater in the diversion system enters the storage tank and other collection facilities, due to its relatively clean water quality, it can be used on-site for greening, road sprinkling and other purposes after simple sedimentation and disinfection. However, when a combined sewer system is used, the pollutant concentration in the water entering the storage tank is high, which requires a more complex purification

process when it is used. It may even have to be discharged into a sewage treatment plant for subsequent treatment after rainfall, which greatly increases carbon emissions.

2. Sewage system emission reduction path

(i) Source control

554. The main activity of sewage treatment plants is to treat various pollutants in domestic sewage, which consumes a lot of energy and medicine, and indirectly causes corresponding greenhouse gas emissions and air pollution, which is suspected of "pollution transfer". Therefore, trying to reduce the required sewage treatment level can effectively reduce the carbon emission level of sewage treatment plants from the source.

(ii) Automated control of sewage treatment

555. Relying on the development of information technology, modern sewage treatment plants can use sophisticated sensors and control equipment to collect, transmit, store, process and serve water information, improve the efficiency and effectiveness of sewage treatment, and realize comprehensive monitoring, scientific decision-making, automatic control and timely response of the sewage control process, ultimately realizing the automated operation of sewage treatment plants.

(iii) Compact sewage treatment process

556. During the sewage treatment process, the operation of the bioreactor requires stirring, aeration and reflux, which consumes a lot of electricity. The indirect carbon emissions generated by this account for about 18% of the total carbon emissions of the sewage treatment plant. Therefore, by improving the sewage treatment efficiency and load and reducing the size of the reactor, the carbon emissions generated by the construction and building materials consumption during its planning and construction can be reduced, as well as the indirect carbon emissions generated by the electricity consumption of various mechanical operations and the treatment of consumed chemicals during operation and maintenance.

(iv) High-efficiency denitrification technology

557. Nitrogen is one of the main pollutants in domestic sewage. Excessive nitrogen concentration discharged into natural water bodies will lead to environmental problems such as black and smelly water bodies and eutrophication of water bodies. The biological denitrification process used in traditional sewage treatment has a complex reaction process and requires an aerobic and anoxic environment. Therefore, the reactor volume is large, the operating equipment is numerous, and the loss and energy consumption are high. In addition, the traditional biological denitrification process also consumes a certain amount of organic carbon source. If the organic matter (COD) content of domestic sewage is insufficient, the sewage treatment plant may need to add additional organic carbon source, thereby generating additional carbon emissions. Therefore, the use of efficient denitrification technology, shortening the denitrification process, reducing the reactor volume and mechanical energy consumption, and saving reagent consumption can effectively reduce the indirect carbon emissions generated during the denitrification process.

(v) Wastewater resource recovery

558. Municipal sewage and residual sludge are rich in a variety of resources, such as phosphorus, macromolecular organic matter and other high value-added products. After proper treatment, recycling and recycling them can not only generate certain economic benefits, but also serve as a substitute for corresponding products, thus shortening the mining and production process of the original products and their raw materials, and reducing their total carbon emissions.

7 Social Impact and Risk Analysis and Mitigation Measures

7.1 SIA Tasks

559. According to AIIB's ESF, the purpose of the SIA is to avoid or minimize adverse E&S risks and impacts, and where such risks and impacts are inevitable, identify such risks and impacts, define the SIA area and timeframe, determine key influencing factors, collect baseline data, assess the intensity and range of impacts, develop and implement necessary mitigation measures, monitor cumulative impacts during construction and operation, and adjust the management measures dynamically through a cumulative impact assessment (CIA)²¹ according to the applicable PRC laws and AIIB's ESP, thereby ensuring that cumulative impacts are acceptable.

560. Therefore, the Social Impact Assessment aims to identify the positive and negative impacts of the Project through participatory methods such as literature collection, field visits, questionnaire survey, FGDs, in-depth interviews, and organization interviews. Through the Social Management Plan, potential social risks of the Project are avoided, the project design is improved, the basic rights and interests of all stakeholders are protected, and fair participation of all stakeholders in the Project is promoted. Therefore, the main tasks of this social impact assessment are:

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

2) Investigating the applicability of ESS3—Indigenous Peoples;

3) Learning the Project's potential positive and negative social impacts, and identifying potential social risks according to AIIB's ESF;

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

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

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

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

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

8) Identifying the Project's potential risks and impacts, and developing mitigation measures to mitigate such risks and impacts, and promote the realization of the project objectives; using gender-segregated data, and improving the project design to promote equal opportunities, and

²¹ Cumulative Impact Assessment (CIA) mainly analyzes and studies the sources, processes, and ultimate cumulative impacts of cumulative impacts, explains their accumulation in time and space, estimates and predicts the cumulative impacts of completed, existing, and upcoming human activities and their feedback on socio-economic development, and recommends that the direction, content, scale, speed, and mode of activities should be consistent with sustainable development goals.

women's economic and social empowerment, especially in terms of service rendering and employment

7.2 Object and Scope of SIA

7.2.1 Subjects of SIA

561. The subjects of SIA for the Project are the primary and secondary stakeholders of the Project. Among them, primary stakeholders are the direct beneficiaries within the scope of the Project and the groups negatively affected by the Project, including residents, vulnerable groups, those affected by LAR, enterprises and public institutions, shops, schools, teachers and students within the project scope of Xinglongtai, Shuangtaizi and Dawa Districts, Panjin City, as well as the townships / sub-districts along the Liaohe River, Yitong River, Pangxie Ditch, Qingshui River, and Zhaoquan River.

562. Secondary stakeholders include the Panjin PMO, PMCC, SDHURDB, XDHURDB, DDHURDB, Agriculture and Rural Bureau, Panjin Emergency Bureau, county-level/district-level House Expropriation Affair Center, Panjin Natural Resources Planning Bureau, Panjin Statistics Bureau, Panjin Ecology and environment bureau, Panjin Human Resources and Social Security Bureau, Panjin Rural Revitalization Bureau, Panjin Citizen Ethnic Affairs Committee, Panjin Women's Federation, Panjin Municipal Civil Affairs Bureau, and Panjin Transport management bureau, Tiedong, Hongqi, Liaohe, Jianshe, Shuangsheng, Shengli, Lujia Town, Tianjia, Dawa, Xinglong, Xinghai, Bohai, Xingong, Zhenxing, Chuangxin, Huibin, and Xingsheng Sub-districts, design agency, contractors, supervising agency, external monitoring agency, etc. In addition, special attention should be paid to vulnerable groups and women in livelihood restoration and public participation.

7.2.2 Scope of SIA

563. The scope of SIA for the Project includes 17 townships / sub-districts in 3 districts within the 41 subcomponents in Panjin City, as well as stakeholders such as affected villages / communities along lines.

7.2.3 Key points of SIA

564. The SIA is focused on the following:

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

- Various post-disaster issues such as siltation of rivers, damaged slope protection, water damage to embankments, water quality, flood control standards, river management, and ecological restoration along the Yitong River, Liaohe River, Pangxie Ditch, Qingshui River, and Zhaoquan River in the project area;
- The restoration of urban river infrastructure, the restoration of wastewater interception pipelines, the expansion of road crossings, the construction of sewer networks, the improvement of flood discharge capacity of urban interception ditches, and the enhancement and restoration of flood control capacity of urban river bridges (bridge demolition, reconstruction, reconstruction, widening, etc.) in the project area;
- Restoration of scattered damaged urban roads, improvement of urban road lanes, and restoration of road facilities (such as traffic, drainage, lighting, greening, etc.) involved in the project area.

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

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

4) Analyzing potential GBV issues in project implementation, the Project's impacts on women and

their needs for the Project, and identifying any gender difference;

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

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

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

7.3 Social Impact Analysis

565. The ESIA unit, in close cooperation with the Panjin PMO, PMCC, SDHURDB, XDHURDB, DDHURDB, county-level/district-level House Expropriation Affair Center, Panjin Municipal Natural Resources Bureau Acquisition Office, Agriculture and Rural Affairs Bureau, relevant sub-district offices, proprietors, communities/village groups, and individuals, completed a one-on-one face-to-face questionnaire survey of 500 copies of the questionnaire in the three project districts within the project area during July 9-17, 2024. After statistical testing and screening, there were 500 valid copies of the questionnaire, with an effectiveness rate of 100%. The respondents cover different age groups, education levels, and occupations, including 263 males and 237 females. In addition, the ESIA unit conducted 18 resident FGDs with 312 participants, of which 91 were female participants, accounting for 29.17% of the total.

566. According to the on-site survey conducted by the ESIA unit, the implementation of the Project benefits 17 townships / sub-districts in Xinglongtai, Shuangtaizi and Dawa Districts, Panjin City, and the area affected by construction is 200m around the construction sites.

7.3.1 Social benefits

Table 7-1 Summary of Social Benefits

Component	Affected sub-district / township	Social benefits
Wetland restoration and conservation	Xinglongtai District: Xinghai Sub-district Bohai Sub-district Xingong Sub-district Zhenxing Sub-district Chuangxin Sub-district Huibin Sub-district Xingsheng Sub-district Shuangtaizi District: Tiedong Sub-district Hongqi Sub-district Liaohe Sub-district Jianshe Sub-district Shuangsheng Sub-district Shengli Sub-district Lujia Town Dawa District: Tianjia Sub-district Dawa Sub-district	<p>1) Reconstruct the water system connectivity network in Panjin City and open up urban drainage channels.</p> <p>A. By scientifically planning and restoring natural water systems, improving urban drainage capacity and effectively reducing floods;</p> <p>B. Open up urban drainage channels, achieve natural circulation and rational allocation of water resources through measures such as rainwater collection, river-lake connection and wetland construction, enhance water regulation functions, and promote ecological balance.</p> <p>2) Eliminate flood prone areas in the urban area and reduce impacts of waterlogging disasters.</p> <p>A. Solving urban waterlogging problems through measures such as drainage system reconstruction, low-lying area improvement, and increasing green spaces;</p> <p>B. Strengthen the construction of storage tanks and pump stations, reduce the accumulation of water in rainstorm, ensure the safety of residents and smooth traffic, and improve the disaster prevention ability of cities to cope with climate change;</p> <p>C. Ensure life and property safety in the urban area, guarantee the travel of nearby residents, and improve the efficiency of residents' traffic.</p> <p>3) Conduct low impact development to enhance ecological service functions.</p> <p>A. Low impact development reduces rainwater runoff and promotes natural water circulation through ecological facilities such as green spaces, wetlands, and permeable pavements;</p> <p>B. Effectively enhancing urban ecological service functions, improving air quality, regulating temperature, and enhancing urban sustainable development capacity through water resource management and green infrastructure construction;</p> <p>C. Introduce sponge facilities such as permeable pavements on sidewalks and ecological tree ponds to achieve total annual runoff control within roads and reduce rainwater emissions at the source.</p> <p>4) Extend green production and development, and promote a green lifestyle.</p>

Component	Affected sub-district / township	Social benefits
		<p>A. Promote sustainable development in fields such as ecological agriculture and tourism through ecological restoration and green production models;</p> <p>B. Increase green job opportunities, enhance the environmental awareness of urban residents, promote the popularization of low-carbon lifestyles, and drive the transformation of society towards circular economy and sustainable consumption patterns.</p> <p>5) Meet residents' leisure needs and improve their living quality.</p> <p>A. Provide more green spaces, wetlands, and parks to meet the leisure and entertainment needs of residents;</p> <p>B. Improve the urban ecological environment, enhance residents' health and happiness, create a more livable urban life, promote community integration and social harmony, and provide high-quality living space for future development.</p>
Sponge city infrastructure transformation	<p>Xinglongtai District: Xinghai Sub-district Bohai Sub-district Xingong Sub-district Zhenxing Sub-district Chuangxin Sub-district Huibin Sub-district Xingsheng Sub-district Shuangtaizi District: Tiedong Sub-district Hongqi Sub-district Liaohe Sub-district Jianshe Sub-district Shuangsheng Sub-district Shengli Sub-district Lujia Town Dawa District: Tianjia Sub-district Dawa Sub-district</p>	<p>1) Improve drainage facilities and solve pipeline congestion.</p> <p>A. Update and replace the old water pipes with updated specifications to increase the drainage capacity of the rainwater system;</p> <p>B. Increase the capacity of the sewer network by expanding and repairing existing drainage pipelines, improving the capacity and efficiency of the drainage system, and reducing congestion;</p> <p>C. Introduce intelligent management, use sensors to monitor water level and flow, timely clear pipelines, and improve drainage efficiency and safety;</p> <p>D. Upgrade old pump station facilities, enhance the capacity of key drainage nodes, and ensure rapid drainage even during heavy rain.</p> <p>2) Eliminate waterlogging prone areas and reduce floods.</p> <p>A. Increase drainage facilities, such as pump stations and storage tanks, in low-lying areas to ensure rapid drainage of rainwater;</p> <p>B. Optimize urban terrain, improve urban drainage layout, utilize permeable materials and green spaces to reduce surface runoff;</p> <p>C. Improve rainwater collection by reducing drainage pressure and minimizing the possibility of water accumulation through rainwater collection systems.</p> <p>3) Reduce the frequency of wastewater overflow and solve the problem of overflow pollution.</p> <p>A. Enhance the capacity of the sewer network by upgrading the sewer network to prevent wastewater from overflowing into rivers during heavy rain and reduce water pollution;</p> <p>B. Construct wastewater storage tanks, increase storage facilities, store overflow wastewater, and avoid direct discharge of untreated wastewater;</p> <p>C. Improvement of interception facilities, adding interception devices to ensure that wastewater is directed to treatment facilities rather than directly discharged.</p> <p>4) Separate wastewater and rainwater to improve the urban water environment.</p> <p>A. Implement a diversion system for drainage, separate wastewater and rainwater for discharge, avoid mixed pollution, and reduce the phenomenon of wastewater overflow;</p> <p>B. Construct a new diversion sewer network and renovate the drainage system in old the urban area to achieve independent treatment of wastewater and rainwater;</p> <p>C. Reduce rainwater runoff pressure, reduce the burden on the drainage system through diversion system, improve drainage efficiency, and enhance the water environment.</p> <p>5) Renew old equipment and improve operational services.</p> <p>A. Upgrade the sewer network, replace aging pipelines, improve drainage efficiency, and reduce pipeline failures and blockages;</p> <p>B. Intelligent pump station management, introducing automatic control systems to improve the operational efficiency of pump stations and reduce manual intervention;</p> <p>c. Adopt advanced treatment technologies, update wastewater treatment plant equipment, improve wastewater treatment capacity and water quality, and reduce pollution.</p> <p>6) Realize source emission reduction and build a sponge city.</p> <p>A. Increase green spaces and wetlands, absorb rainwater through natural facilities, reduce rainwater runoff, and enhance ecological regulation functions;</p>

Component	Affected sub-district / township	Social benefits
		B. Permeable pavement application, laying permeable materials in cities to reduce rainwater retention and lower drainage pressure; C. Rainwater garden construction, through ecological design such as rainwater gardens, stores and purifies rainwater to achieve natural circulation.

567. Overall, based on fieldwork and statistical analysis of 500 copies of the questionnaire, it can be found that residents in the three project counties think that the implementation of the Project will have the following positive impacts: (1) 76.80% of the respondents think that the Project can reduce impacts of floods; (2) 72.20% of the respondents think that it can make their living safer; (3) 58.40% of the respondents think that the Project can improve the traffic congestion in Panjin urban area and along the river; (4) 52% of the respondents think that the wastewater facilities in Panjin City can be improved to solve the problem of inland river wastewater blockage; (5) 52% of the respondents think that project construction will improve conditions such as soil erosion and water pollution; (6) 44.40% of the respondents think that the Project will beautify the riverside scenery and increase tourism related income; (7) 16.60% of the respondents think that project construction will increase job opportunities.

Table 7-2- Perceived Positive Impacts of the Project

Indicator Option	Potential positive impact							
	Reducing flood impacts	Making lives safer	Improving traffic congestion	improving urban sewer facilities, and solving the blocking problem	Improving soil and water loss, water pollution, etc.	Beautifying the riverside landscape, and increasing tourism income	Generating more job opportunities	Don't know
sample size	384	361	292	260	260	222	83	19
Proportion	76.80%	72.20%	58.40%	52%	52%	44.40%	16.60%	3.80%

7.3.1.1 Reconstruct the water system connectivity network in Panjin City and connect urban drainage channels.

568. Reconstructing the water system connectivity network in Panjin City, in rapidly expanding the urban area, water systems are often cut off, buried, or artificially modified, resulting in blocked natural drainage channels and imbalanced water circulation systems. Opening the urban drainage channel is an important part of urban water system reconstruction. Due to the overload operation of the underground pipe network all the year round, it is difficult to cope with extreme precipitation weather, especially in the rainstorm season, which is easy to cause local urban waterlogging; By optimizing the water system and connecting the natural drainage channels of the city, sufficient storage space can be provided for the drainage system to enhance its drainage capacity. Through these measures, the drainage capacity of the city has been significantly improved, the risk of floods has been reduced, and the sustainable development capacity of the city and the sense of security of residents' lives have been further enhanced.

569. The ESIA unit found through on-site interviews and questionnaire surveys that the river basins in Panjin City have insufficient water flow on weekdays, and floods rarely occur. The flood control facilities and related supporting facilities along lines also do not meet the corresponding standards. With the completion of the Project, the flood control standards within and outside the urban area of Panjin City will be improved. The survey results show that 72.22% of the respondents think that project construction will make their living safer, and 76.85% of the respondents think that it can reduce impacts of floods. Therefore, the construction of the Project has positive significance in stabilizing the river embankment, improving flood control capacity, reducing impacts of floods and other disasters, and making the living and livelihood of residents along the unified river, Liaohe River, and urban river channels safer. The restoration of ecological shorelines and reinforcement of guardrails in the urban area such as Yitong River, Liaohe River, and Pangxie Ditch are the aspirations and directions of the people.

Interview 7-1: Mr. Zhang (42 years old) in Tiedong Sub-district, Shuangtaizi District

Every time it rains heavily, it's very inconvenient. We have been looking forward to the reconstruction of the sewer network for a long time. The Project can facilitate our daily traffic, manage the river and provide us with a pleasant entertainment and leisure environment, and is a very good livelihood project, and we will definitely support it.

7.3.1.2 Improve drainage facilities to solve pipeline congestion.

570. The survey results show that 97.12% of the respondents have a moderate or above demand for drainage facilities. The ESIA unit found during the fieldwork and resident interviews that, especially in some old urban areas, the sewer network was mostly built decades ago, with aging facilities and insufficient pipeline capacity, making it difficult to meet the current demand for heavy rains and wastewater discharge. Improving drainage facilities is not only about expanding or repairing pipelines, but also a comprehensive modernization upgrade of the drainage system.

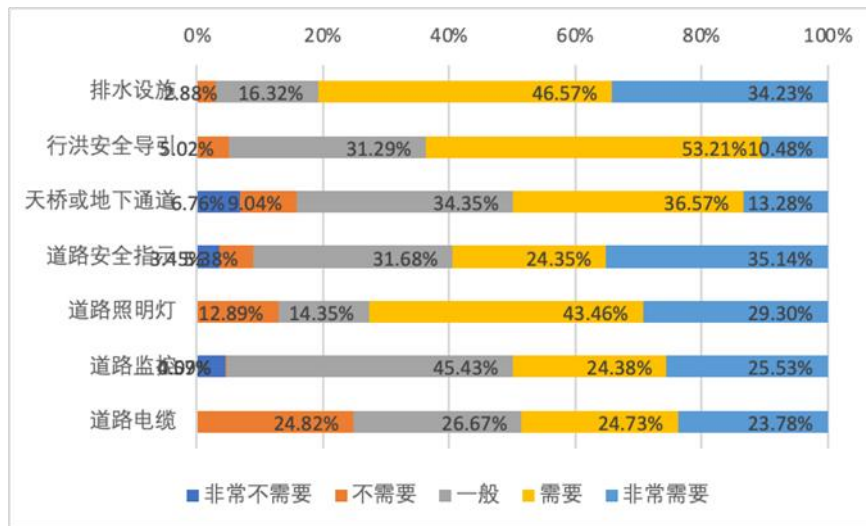


Figure 7-1 Demand for Municipal Infrastructure by local residents

7.3.1.3 Eliminate flood prone areas in the urban area and reduce impacts of waterlogging disasters.

571. The formation of flood prone areas in the urban area is mainly due to inadequate drainage system design, low-lying terrain, and outdated infrastructure in the process of urbanization. During rainstorm or long-term rainfall, these areas are prone to ponding, resulting in traffic interruption, water ingress into houses, and even endangering the safety of residents' lives and property.

572. In common flood prone areas such as low-lying neighborhoods, areas covered by old drainage systems, and entrances to underground parking garages, give priority to renovating old pipe networks, adding pump stations, constructing storage tanks, and ensuring that the drainage system can cope with sudden heavy rains; in low-lying areas, it is also necessary to consider methods such as land leveling, filling, and adding drainage channels to reduce the accumulation of waterlogging. And increase green space and vegetation coverage to alleviate the pressure of surface runoff, improve surface water circulation, and reduce the time rainwater stays on the ground; By introducing the concept of "sponge city", the city's water absorption and drainage capacity can be improved, and excess rainwater can be stored and slowly discharged. Through the above measures, the number of urban waterlogging sites will be greatly reduced, and citizens' lives and travel will be safer and more convenient.

Interview 7-2: Mr. Zhang (35 years old) in Dawa Sub-district, Dawa District

After last year's flood, the pedestrian walkways we pass through every day were damaged and have not been repaired yet. It is very inconvenient for us to travel. There are also no guardrails along the river, which poses many safety risks.

7.3.1.4 Reduce the frequency of wastewater overflow and solve the problem of overflow pollution.

573. The problem of wastewater overflow in urban sewer networks has long plagued the water environment management of Panjin City. Especially in rainstorm, wastewater and rainwater flow into the pipeline at the same time. When the capacity of the drainage system is insufficient, untreated wastewater will overflow and directly discharge into rivers, lakes and other natural water bodies, causing serious environmental pollution. This phenomenon not only damages the water environment of the city, but also threatens the health of residents and the ecological system of the city.

574. The core of reducing the frequency of wastewater overflow is to improve the carrying capacity and treatment efficiency of the sewer network. First, the city needs to upgrade and renovate the existing sewer network by adding rainwater storage tanks or diversion pipelines to alleviate the pressure on the drainage system during heavy rain. Second, build more wastewater treatment facilities to ensure that wastewater can be fully treated instead of being directly discharged into water bodies when overflow occurs. In addition, interception facilities should be added to ensure that wastewater can be intercepted into the treatment system rather than overflowed during rainstorm.

575. Through these measures, the frequency of urban wastewater overflow will be greatly reduced, and the problem of overflow pollution will be effectively solved. The reduction of wastewater overflow can not only improve the water quality of the city, reduce river and lake pollution, but also enhance the environmental quality of the city and the living health level of residents.

Interview 7-3: Mr. Qi (35 years old) in Tiedong Sub-district, Shuangtaizi

The drainage from the residential area to the road will have problems during the rainy season. We have reported this many times, but there has been no improvement every year. We hope to repair the drainage and wastewater treatment facilities in the urban area as soon as possible

7.3.1.5 Improve the urban water environment through wastewater and rainwater separation.

576. In many drainage systems in Panjin City, rainwater and wastewater have not been separated. Wastewater and rainwater use the same drainage system (combined system), which is easy to cause wastewater overflow and water pollution in rainstorm weather. The effective way to solve this problem is to implement the separation of wastewater and rainwater. The diversion system treats wastewater and rainwater separately through different pipelines. Wastewater enters the treatment facility, while rainwater is directly discharged into natural water bodies, thus avoiding pollution arising from the mixing of the two.

577. The implementation of wastewater and rainwater separation requires a comprehensive reconstruction of the urban drainage system, including the construction or reconstruction of pipeline facilities, to ensure that wastewater and rainwater can be treated through independent systems. After the implementation of diversion, rainwater will not mix with wastewater during rainstorm, reducing the risk of wastewater overflow, and improving the water quality of the city. In addition, after entering the treatment system, the wastewater is treated before being discharged, which will also reduce pollution to natural water bodies. The diversion of wastewater and rainwater can not only significantly improve the urban water environment, but also enhance the efficiency and response capacity of the overall urban drainage system.

7.3.1.6 Renew old equipment and improve operational services.

578. As time goes by, much equipment in the drainage system gradually ages, and the operational efficiency of facilities such as pipelines, pump stations, and wastewater treatment plants in Panjin City decreases, with frequent failures and difficulty in ensuring the quality of operational services. Renewing old equipment can not only improve the efficiency of drainage facilities, but also reduce energy consumption, lower maintenance costs, and enhance the city's response capacity.

579. The drainage system in Panjin City is undergoing equipment updates, with regular maintenance and updates of the sewer network. Modern pipes and technologies are adopted to extend the service life. The pump station is undergoing intelligent transformation, and an automatic control system is introduced to improve operational efficiency and reduce manual intervention. In addition, the wastewater treatment plant can introduce new treatment technologies to improve the efficiency of wastewater treatment and ensure that the discharged water quality meets the standards.

580. Renewing old equipment can not only improve the service quality of the drainage system, but also reduce service interruptions arising from equipment failures, and enhance residents' satisfaction with urban drainage services. In the long run, the application of modern equipment can also reduce environmental pollution, lower maintenance costs, and help cities achieve sustainable development.

7.3.1.7 Extend green production and development, and promote a green lifestyle.

581. In the process of promoting ecological projects, extending green production and development, and promoting a green lifestyle are important goals for achieving a win-win situation between ecology and society. Green production and development emphasizes reducing resource waste and environmental pollution in economic activities, and emphasizes the use of recycling and renewable energy. Through wetland construction, ecological restoration and other projects, Panjin City can effectively promote green production and development in the city and surrounding areas. For example, in ecological agriculture, the natural purification function of wetlands and water resource cycling are utilized to reduce the use of agricultural fertilizers and pesticides, improve crop yield and quality, and promote the sustainable development of green agriculture. In addition, ecological restoration projects can promote the development of ecotourism, inject new vitality into the local economy, increase job opportunities, and promote economic transformation. The survey results show that 44.44% of the respondents think that the Project will enhance the landscape along the river, improve the surrounding natural environment, and increase tourism related income.

582. Meanwhile, green production and development can further promote the popularization of a green lifestyle. Through greening projects, ecological park construction, and environmental education programs, residents can better learn the importance of environmental protection and sustainable development. The mutual promotion of green production and green lifestyle can not only achieve coordinated development of economy and environment, but also improve the living quality and happiness of residents, laying the foundation for achieving sustainable urban development.

Interview 7-4: Mr. Wang (45 years old) in Xinghai Sub-district, Xinglongtai

In 2021, a major flood took place unexpectedly. My wife and I often took a walk along the Shengli Canal after dinner. Now that the river has dried up and water quality is bad, there are fewer people by the river, and it's not as lively as before. We support the Project very much and hope it to be completed as soon as possible, so that this place can regain vitality.

7.3.1.8 Meet residents' leisure needs and improve their living quality.

583. Ecological construction and restoration not only improves the environmental quality of cities, but also provides residents with more leisure and entertainment spaces, thereby enhancing the overall living quality. With the rapid advancement of urbanization, the reduction of natural spaces such as green spaces, wetlands, and parks has increased the pressure on residents' lives and reduced opportunities for leisure activities. Ecological wetlands, urban green spaces, ecological shorelines, and other projects

that restore and construct natural landscapes not only help improve the beauty of cities, but also provide residents with rich leisure places.

584. These projects can meet the daily sports, entertainment, and social needs of residents. For example, ecological green spaces provide a comfortable environment for running, walking, and parent-child activities; in addition, with the improvement of the ecological environment, more green spaces and natural environments can help alleviate stress, reduce the incidence of depression and anxiety, and enhance residents' sense of happiness. By meeting the leisure needs of residents, ecological construction not only enhances the livability of cities, but also creates a higher quality living environment for residents.

Interview 7-5: Ms. Kong (55 years old) in Xinglong Sub-district, Xinglongtai District

We didn't expect that we would reach the park with a short walk from here. There are still quite a few people who come for leisurely walks. The guardrails have been repaired and the ecological environment has been improved. Not only is it more convenient for us to travel, but it can also beautify our city landscape.

7.3.1.9 Realize source emission reduction and build a sponge city.

585. The source emission reduction measures of the Project include the construction of natural facilities such as green spaces, wetlands, and rain gardens, the use of permeable paving, and the introduction of building rainwater collection systems. These measures can not only reduce rainwater runoff, reduce the pressure of drainage pipe network during rainstorm, but also effectively reduce water pollution and improve the utilization efficiency of urban water resources. By achieving emissions reduction at the source and building a sponge city, the city's flood control and flood resistance capabilities will be enhanced, water resources will be fully utilized, and the urban ecological environment will be significantly improved.

586. The ESIA unit learned during on-site visits that the areas along the Yitong River, Liaohe River, Pangxie Ditch, Qingshui River, Zhaoquan River and their tributaries, as well as nearby parks, are the preferred leisure and entertainment destinations for residents in Panjin City. After work, a large number of residents, old people, and children will go for leisure and entertainment activities such as walking, square dancing, and listening to plays along the Yitong River, Liaohe River, Pangxie Ditch, Qingshui River, and Zhaoquan River.

587. Currently, there are problems of river collapse and insufficient greening function along the rivers inside and outside the urban area of Panjin City, which have not provided residents with a good rest experience. The residents along lines are looking forward to the widening of the water surface of the inland waterway in Panjin City with the completion of the Project, thus forming an open waterfront visual interface, providing residents with a good walking experience, and meeting the diverse urban waterfront landscape needs of children, students, young adults, and old people.

Interview 7-6: Mr. Cui (45 years old) in Shuangsheng Sub-district, Shuangtaizi District

The sewer lines here have been in compliance with the standards of many years ago, and they cannot cope with the current rainwater and wastewater. Moreover, wastewater is not separated separately. Rainwater can be reused, while wastewater can be treated and recycled. It is impossible to directly discharge wastewater into the river. Sometimes we can even take a walk by the river, and no one dares to go there if wastewater is discharged. We should follow environmental protection measures strictly. Rainwater and wastewater separation is ecofriendly.

7.3.1.10 Promote regional development and increase employment opportunities

588. First of all, it will promote the economic development of the project area. A large number of residential areas, commercial areas, work units, residents' leisure areas and river landscape parks are

distributed around the river in Panjin City, which has a large flow of people. Panjin municipal water conservancy project construction will enhance the city's rivers, roads and other infrastructure, attracting developers in the Yitong River, Liao River, crab ditch, Qingshui River, Zhaohuan River development and construction along the line, thus driving the development and construction along the commercial and residential layout. At the same time, with the widening and repair of urban roads in Panjin City, residents will travel more conveniently.

589. Secondly, during the construction and operation of the project, some technical and non-technical jobs will be generated, such as the transportation of construction materials, the construction of houses and the catering service of the construction team during the construction. After the completion of the project, the management and service personnel positions in each river management station, cleaning and security, river cleaning and maintenance, etc. Through discussions and interviews with the Panjin PMO and PIU, the Panjin PMO will urge the project construction unit and operation management department to give priority to providing such employment opportunities to the surplus labor force in the project area and surrounding areas, especially to the vulnerable groups including women, the elderly and the low-income population who have the ability to work. Help low-income groups increase their incomes.

590. However, the survey results also show that 16.67% of residents believe that project construction can increase employment opportunities; It can be seen that local residents are cautious about the economic driving effect of the project (because in the discussion, residents along the line told the survey team that they need more long-term work opportunities, 1-2 months of work, most of them are not willing to do; This is mainly because the project cycle is short and temporary workers are not sustainable, and when the construction period is over, their original long-term employment opportunities are lost).

7.3.2 Social risks

Table 7-3 Social risk list

Component	Affected sub-district / township	Social risks	
Wetland restoration and conservation project		Construction stage	<p>1) LA impacts: This component will occupy 190.67 mu of land of state-owned farms, affecting 9 households with 35 people, involving economic other than physical displacement.</p> <p>2) Negative natural and social environmental impacts generated during construction:</p> <p>A. Air pollution risk, as well as the dust and exhaust emissions arising from the operation of motor vehicles during construction such as earthwork excavation and water pipe landfill, and the increase in nonlocal vehicles.</p> <p>B. Noise pollution risk, mechanical equipment noise generated by excavators and mixers during soil excavation and pipeline laying during construction, knocking and cutting noise, truck transport noise, and noise generated by pump station equipment debugging.</p> <p>C. Water pollution risk. Pollution of surface water, especially drinking water in residential areas, during construction.</p> <p>3) Impacts of nonlocal labor:</p> <p>A. The risk of influx of nonlocal laborers, and increased communication and contact between nonlocal laborers and residents along the project line, which can easily lead to security conflicts and problems.</p> <p>B. Health risks, to a certain extent, increase the intensity of communication and interaction with local residents, which can easily lead to the spread of certain communicable or pandemic diseases and other health risks.</p> <p>C. The influx of a large number of laborers will increase the consumption of resources such as water, electricity, and food, especially during construction. The construction of living areas and the disposal of domestic waste will cause additional pressure on the local environment, leading to a shortage of production and living resources for local residents.</p>

Component	Affected sub-district / township	Social risks	
	Xinglongtai District: Youyi Sub-district Dawa District: Tianjia and Dawa Sub-districts		<p>D. The risk of cultural differences, where the cultural background of migrant workers differs significantly from the local culture, may lead to cultural conflicts or misunderstandings, resulting in social conflicts. For example, differences in religious belief, lifestyle, and values may lead to adaptation issues or exclusionary emotions.</p> <p>4) Traffic safety impacts</p> <p>A. Impacts of road closure and traffic congestion, such as pipeline excavation, river slopes, and the need to close or semi-close roads during construction, will increase traffic pressure and can easily lead to traffic congestion. Traffic diversion also increases potential traffic accidents.</p> <p>B. Impacts of construction vehicles on road safety. During construction, a large number of trucks, excavators, and construction vehicles frequently enter and exit the construction area. These vehicles are large in size and slow in speed, which may cause inconvenience or even traffic accidents. These vehicles may temporarily occupy road space during loading and unloading, increasing road safety risks.</p> <p>C. Road surface damage and safety risks: Frequent crushing of roads by large construction vehicles during the project may result in road surface damage and increased potholes; during the excavation of pipelines or river slope protection, temporary roads or bridges are often used for vehicles and pedestrians to pass through. The quality and safety of these temporary facilities may not be as good as formal roads, leading to risks of accidents such as collapse and overturning.</p> <p>5) Risks of unfinished construction during the flood season</p> <p>A. Increased economic losses: Due to construction interruptions or delays, repair costs and additional engineering costs will increase, and the contractors and related stakeholders may face enormous economic pressure.</p> <p>B. The non-completion of critical infrastructure will affect residents' daily lives, traffic, and urban functions, leading to a decrease in residents' satisfaction and potentially triggering social conflicts and grievances.</p> <p>C. Impacts of slippery roads on rainy days: Extensive earthwork operations are required for pipeline excavation, slope protection construction, or wetland construction. On rainy days, soil is easily washed onto the road, causing it to become slippery and increasing the risk of vehicle slippage and loss of control, especially for two-wheelers such as electric vehicles.</p> <p>6) Gender impacts: Gender inequality may occur during construction and in daily affairs on the construction site, including discrimination against women in terms of working hours, resulting in physical, mental, or sexual harm to women, including GBV such as threats, coercion, or arbitrary deprivation of freedom.</p>
		Operation stage	<p>1) Potential social risks during project operation</p> <p>A. Employment imbalance and project operation may lead to changes in the labor market within the region. Some positions may require specialized skills, which local labor may not be able to meet, leading to skill mismatches and unequal employment opportunities.</p> <p>B. Conflict in resource allocation: Projects may generate significant demand for local water resources, land, energy, and other resources, which may affect the supply of resources to local residents or other businesses, potentially leading to conflicts, especially in situations of resource scarcity or uneven distribution.</p> <p>C. Air and noise pollution, if significant air or noise pollution is generated during project operation, may affect the health and quality of life of surrounding residents. For example, the operation of industrial projects, transportation projects, or large-scale infrastructure may result in</p>

Component	Affected sub-district / township	Social risks	
			<p>sustained noise or exhaust emissions, affecting the daily lives of residents.</p> <p>2) Traffic safety risks</p> <p>A. After wetlands or ecological areas attract tourists, the influx of tourist vehicles may have an impact on the transportation of local residents, especially when road capacity is insufficient.</p> <p>B. After wetland construction and ecological restoration, it may attract frequent visits from tourists, researchers, etc., leading to an increase in local traffic flow, especially at the entrance of scenic spots, parking lots, and surrounding roads.</p> <p>3) Labor management risk</p> <p>A. Social security risks, the influx of a large number of migrants may bring security risks, especially in the case of insufficient social management resources, which may increase crime rates or social security issues.</p> <p>B. During the operation period, it may involve wetland maintenance, equipment inspection, water resource management, and other work, which may pose occupational health and safety hazards due to exposure to natural environments (such as wetland moisture, mosquito bites) or operation of mechanical equipment.</p> <p>C. The operation of wetland and ecological restoration projects requires professional skills (such as ecological monitoring, environmental management, wetland maintenance), and if labor lacks relevant training or experience, it may be difficult to meet the job requirements.</p> <p>4) Risk of insufficient participation of vulnerable groups</p> <p>A. The risk of uneven distribution of project benefits, where vulnerable groups may struggle to participate fairly in the sharing of project benefits due to insufficient resources, information, or capabilities, such as employment opportunities and economic benefits brought by wetland tourism development, ecological industries, etc.</p> <p>B. The risk of uneven utilization of social resource services, wetland projects may focus on improving certain social services (such as education, healthcare, transportation, etc.), but vulnerable groups may not be able to enjoy these resources fairly due to geographical location, economic conditions, and other limitations.</p>
Sponge city infrastructure transformation	<p>Xinglongtai District: Xingsheng Sub-district</p> <p>Shuangtaizi District: Liaohe Sub-district, Tiedong Sub-district</p> <p>Dawa District: Dawa Sub-district</p>	Construction on stage	<p>1) LA impacts: This component will affect 74 households with 209 people, including 48 economically displaced households with 140 people and 26 physically displaced households with 69 people, involving the acquisition of 28.5 mu of collective land, affecting 50 households with 153 people, the occupation of 13.62 mu of state-owned land, affecting no one, and the demolition of houses of 16,134 m², affecting 72 households with 204 people, including residential houses of 3,793 m², affecting 26 households with 69 people, and nonresidential buildings of 12,341 m², affecting 46 households with 135 people, and the temporary occupation of 5 mu of collective land, affecting two households with 5 people.</p> <p>2) Negative natural and social environmental impacts generated during construction:</p> <p>A. Air pollution risk, as well as the dust and exhaust emissions arising from the operation of motor vehicles during construction such as earthwork excavation and water pipe landfill, and the increase in nonlocal vehicles.</p> <p>B. Noise pollution risk, mechanical equipment noise generated by excavators and mixers during soil excavation and pipeline laying during construction, knocking and cutting noise, truck transport noise, and noise generated by pump station equipment debugging.</p> <p>C. Water pollution risk. Pollution of surface water, especially drinking</p>

Component	Affected sub-district / township	Social risks
		<p>water in residential areas, during construction.</p> <p>3) Impacts of nonlocal labor:</p> <p>A. The risk of influx of nonlocal laborers, increased communication and contact between nonlocal laborers and residents along the project line, can easily lead to security conflicts and problems.</p> <p>B. Health risks, to a certain extent, increase the intensity of communication and interaction with local residents, which can easily lead to the spread of certain communicable or pandemic diseases and other health risks.</p> <p>C. The influx of a large number of laborers will increase the consumption of resources such as water, electricity, and food, especially during construction. The construction of living areas and the disposal of domestic waste will cause additional pressure on the local environment, leading to a shortage of production and living resources for local residents.</p> <p>D. The risk of cultural differences, where the cultural background of migrant workers differs significantly from the local culture, may lead to cultural conflicts or misunderstandings, resulting in social conflicts. For example, differences in religious belief, lifestyle, and values may lead to adaptation issues or exclusionary emotions.</p> <p>4) Traffic safety impacts</p> <p>A. Impacts of road closure and traffic congestion, such as pipeline excavation, river slopes, and the construction of new pump stations, requires the closure or semi closure of roads, which increases traffic pressure and easily leads to traffic congestion. Traffic diversion also increases potential traffic accidents.</p> <p>B. Impacts of construction vehicles on road safety. During construction, a large number of trucks, excavators, and construction vehicles frequently enter and exit the construction area. These vehicles are large in size and slow in speed, which may cause inconvenience or even traffic accidents. These vehicles may temporarily occupy road space during loading and unloading, increasing road safety risks.</p> <p>C. Road surface damage and safety risks: Frequent crushing of roads by large construction vehicles during the project may result in road surface damage and increased potholes; during the excavation of pipelines or river slope protection, temporary roads or bridges are often used for vehicles and pedestrians to pass through. The quality and safety of these temporary facilities may not be as good as formal roads, leading to risks of accidents such as collapse and overturning.</p> <p>5) Safety risks of unfinished construction during the flood season</p> <p>A. The intensification of floods makes it difficult for unfinished infrastructure such as sewer networks and pump stations to effectively cope with rainfall during the flood season, which can easily lead to urban waterlogging, increase the risk of flood impact, and affect residents' safety and property.</p> <p>B. Construction safety risks, such as heavy rains during the flood season, may cause water accumulation, soil collapse, and damage to machinery and equipment on the construction site, threatening the safety of workers, delaying the construction period, and even causing accidents.</p> <p>C. Temporary poor drainage may affect the construction of pipelines and drainage systems. During this period, temporary drainage facilities may not be able to cope with sudden heavy rain, resulting in road surface water or even flooding. This not only affects traffic flow, but also leads to problems such as vehicle loss of control or engine water ingress.</p> <p>6) Gender impacts: Gender inequality may occur during construction</p>

Component	Affected sub-district / township	Social risks	
			and in daily affairs on the construction site, including discrimination against women in terms of working hours, resulting in physical, mental, or sexual harm to women, including GBV such as threats, coercion, or arbitrary deprivation of freedom.
		Operation stage	<p>1) Other social risks during the project operation period</p> <p>A. Community health and safety risks, if facilities malfunction due to improper maintenance or poor operation, may lead to sewage overflow or water accumulation, causing health risks such as water source pollution and the spread of infectious diseases.</p> <p>B. Under extreme weather conditions, facilities may not be able to cope with floods, affecting the safe travel and living environment of the community.</p> <p>C. The service coverage is uneven, and the renovated drainage facilities may have differences in regional coverage, and some communities may not have received sufficient services.</p> <p>D. If the drainage facilities fail to achieve the expected effect of the public during operation, it may lead to social dissatisfaction, complaints, and protests.</p> <p>2) Traffic safety risks</p> <p>A. Equipment maintenance or repair occupies roads, and drainage facilities require regular maintenance, which may temporarily occupy road space, causing traffic congestion or affecting pedestrian and vehicle traffic.</p> <p>B. Traffic accidents caused by slippery road surfaces may increase the risk of traffic accidents during rainy days or during facility drainage processes.</p> <p>C. Vehicle traffic restrictions and insufficient road signage pose risks, which can easily lead to traffic chaos or accidents.</p> <p>3) Labor management risk</p> <p>A. Operational environmental risks: During the operation of drainage facilities, workers may come into contact with sewage, toxic gases (such as hydrogen sulfide), and slippery working environments, increasing the likelihood of occupational diseases and work-related injuries.</p> <p>B. There is a shortage of skilled labor, and the operation of facilities has high requirements for skilled workers. If the personnel turnover rate is high, it may affect the normal operation and management of facilities.</p> <p>C. Difficulty in managing temporary workers, temporary workers may be needed during peak maintenance periods, and management negligence may lead to safety accidents or conflicts.</p> <p>D. Insufficient emergency management capabilities, when facilities malfunction or natural disasters occur, workers may face personal safety threats, and the lack of emergency plans will exacerbate risks.</p> <p>4) Risk of insufficient participation of vulnerable groups</p> <p>A. Vulnerable groups are highly affected, and in the maintenance or operation of drainage facilities, some vulnerable groups may be unable to provide timely feedback or seek help due to economic constraints or lack of information channels.</p> <p>B. In important decision-making and emergency response during facility operation, public opinions may be overlooked, affecting the community's sense of identification and support for the project.</p>

7.3.2.1 Potential impacts of LAR arising from project construction

591.LAR for the Project will affect Shuangtaizi, Xinglongtai and Dawa Districts in Panjin City, affecting 83 households with 244 people, including 57 economically displaced households with 175 people (including 46 households with 135 people affected by nonresidential building demolition), and 26 physically displaced households with 69 people. 28.5 mu of collective land will be permanently acquired, affecting

50 households with 153 people; 204.29 mu of state-owned land will be permanently occupied, affecting 31 households with 86 people (22 households with 51 people affected by the demolition of residential houses on state-owned land, and 9 households with 35 people affected by the permanent occupation of land of a state-owned farm); 5 mu of collective land will be temporarily occupied, affecting two households with 5 people; residential houses and nonresidential buildings of 16,134 m² will be demolished, affecting 72 households with 204 people (in which 50 households with 153 people are also affected by LA). The task force has found that: 1) Since the Project is linear in shape, the AHs will be affected slightly in general; 2) In the affected village groups, the percentage of agricultural income to gross income is low, and outside employment is the main income, so LA will have little impact on income; 3) Most APs think that the Project is beneficial, and support LA and the Project as long as compensation is reasonable, fair and timely. An RAP has been prepared for the Subproject according to AIIB's ESF. The Project's resettlement impacts are as follows:

- (1) The Project involves the acquisition of 28.5 mu of collective land, all being collective construction land, affecting 50 households with 153 people Gaojia Village in Tiedong Sub-district in Shuangtaizi District, Panjin City for the construction of secondary trunk roads, motor vehicle lanes, sidewalks and green belts, etc. in Gaojia Pump Station Reconstruction, and Rainwater and Wastewater Separation, affecting 50 households with 153 people (in which 4 households with 18 people are affected by both LA and HD), the demolition of residential houses of 593 m², affecting 4 households with 18 people, and the demolition of nonresidential buildings (junk market, scrapyards, etc.) of 12,341 m², affecting 46 households with 135 people. At present, the land pre-approval documents for this subcomponent are being planned and processed.
- (2) The Project involves the occupation of 204.29 mu of state-owned land, including 56.25 mu of state-owned construction land (currently vacant land on roadsides) within existing roads, affecting no one; 10 mu of state-owned construction land for Bayi Pump Station Reconstruction, and Rainwater and Wastewater Separation, involving the demolition of residential houses of 3,200 m², affecting 22 households with 51 people; and 138.04 mu of land of an existing state-owned farm, affecting 35 farm workers from 9 households. Among them, the Zhonghua Road Drainage Channel occupies 56.25 mu of state-owned construction land in Dawa District, affecting no one. The Rainwater Forced Drainage Pump Station on Chunjiang Street occupies 3.62 mu of land of a suburban state-owned farm in Dawa District (not contracted to households), affecting no one. The Rainwater Pump Station and Associated Works on South Shihua Road (Youyi Street-Huancheng South Street) occupy 134.42 mu of land, affecting 35 farm workers from 9 households, including 125.96 mu of land of a state-owned farm in Xinglongtai District, affecting 35 farm workers from 9 households, and 8.46 mu of land (field ridges) of a state-owned farm in Dawa District, affecting no one. For nonagricultural construction land that is lawfully reclaimed from state-owned farmland and unused land, in accordance with the relevant provisions of the Opinions of the Ministry of Land and Resources and the Ministry of Agriculture on Strengthening the Management of Land Use in State-owned Farms (MLR [2008] No.202), the block comprehensive land prices of adjacent rural collective land will apply.
- (3) The Project involves the temporary occupation of 661.1 mu of land, including 656.1 mu of state-owned land (mainly existing roads and open spaces on roadsides), and 5 mu of collective land (mainly dry land, woodland, and collective construction land), affecting two households with 5 people.
- (4) The Project involves the demolition of residential houses and nonresidential buildings of 16,134 m², affecting 72 households with 204 people. Among them, Bayi Pump Station Reconstruction,

and Rainwater and Wastewater Separation involves the demolition of residential houses on state-owned land of 3,200 m², affecting 22 households with 51 people; Gaojia Pump Station Reconstruction, and Rainwater and Wastewater Separation involves the demolition of residential houses and nonresidential buildings on collective land of 12,934 m², affecting 50 households with 153 people (in which 4 households with 18 people are also affected by LA), including residential houses of 593 m², affecting 4 households with 18 people, and nonresidential buildings of 12,341 m², affecting 46 households with 135 people, all being household operators of junk market, scrapyard, etc., excluding any employee. It is confirmed by the Panjin PMO and district LAR offices that all buildings affected by the Project have been verified, there is no illegal building beyond the scope of verification, and all affected buildings will be compensated for.

592. Those affected by nonresidential building demolition are all household operators of junk market, scrapyard, etc., excluding any employee. According to the economic situation in recent years, junk market and scrapyards are depressed gradually. This area itself is facing planning adjustments, and future business prospects are still unclear. Currently, there is a lack of clear income sources, so livelihood impacts of junk markets on operators are insignificant. At present, these operators' income can only cover rental expenses, and overall operating costs are relatively high. Most of them have already closed down. Due to economic pressure and declining market demand, many operators are unwilling to continue to deal with this industry, and hold a positive attitude to monetary compensation for project implementation and HD. Therefore, for these operators, monetary compensation for HD and other livelihood skills training can actually provide them with certain economic security and help them cope with current livelihood challenges. In case of monetary compensation, competent authorities will conduct a detailed survey on the AHs to learn their basic situation, evaluate their livelihood restoration needs, and provide employment skills training, startup skills training, agricultural skills training, etc. In addition, competent authorities and sub-district offices / village committees in Shuangtaizi District will make social or public welfare jobs to AHs having difficulties in livelihood transformation, and provide rental information for AHs that want to continue with commercial activities. In case of property swap, competent authorities will provide replacement housing to AHs where possible based on their expectations and third-party appraisal results, but this is currently infeasible as there is no suitable station or land available for replacement near the village collective.



Figure 7-3 LAR Range of the Gaojia Pump Station (Red Area)

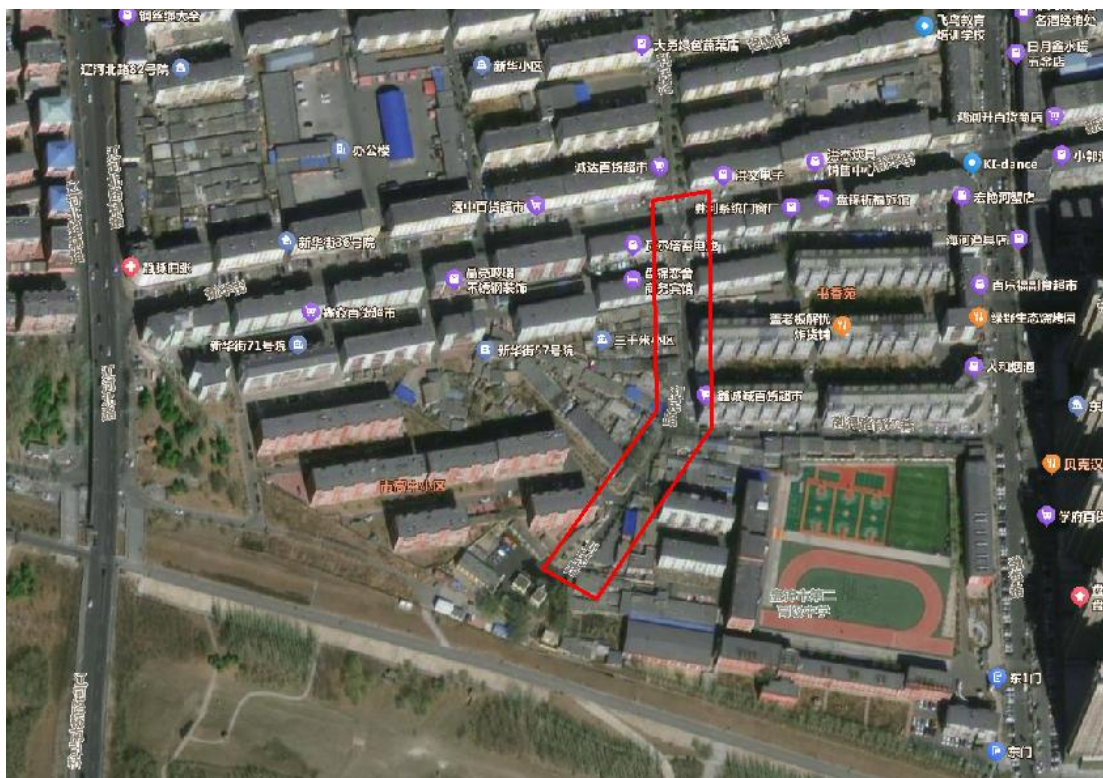


Figure 7-4 LAR Range of the Baiyi Pump Station (Red Area)

Table 7-4 Summary of Economic and Physical Displacement Impacts of the Project

	Economic displacement			Physical displacement		
	LA area (mu)	AHs	APs	HD area (m ²)	AHs	APs
Bayi Pump Station Reconstruction and stormwater and Sewage Diversion Project	0	0	0	3200	22	51
Gaojia Pumping Station Reconstruction and stormwater and Sewage Diversion Project	28.5	46	135	593	4	18

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Zhonghua Road Drainage Channel	56.25	0	0	0	0	0
Chunjiang Street stormwater drainage pump station project	3.62	0	0	0	0	0
Shihua Road South Section (Youyi Street ~ Huancheng South Street) Stormwater Pumping Station and Supporting Project	125.96	9	35	0	0	0
	8.46	0	0	0	0	0
Jinpanhe Street Pumping Station and Upstream stormwater Pipeline Network Reconstruction Project	5	2	5	0	0	0
Total	227.79	57	175	3793	26	69

593. The Project's LAR impacts are detailed in Table 7-4.

Table 7-5 Summary of Resettlement Impacts of the Project

Subcomponent	District	Collective LA					Construction scope involving LA	Occupation of state-owned land			Temporary land occupation (mu)				HD		
		Sub-district	Community / village	Area (mu)	Affected			Area (mu)	AHs	APs	State-owned land	Collective land			Area (m ²)	Affected	
					AHs	APs						Area	Affected			AHs	APs
													AHs	APs			
Yijiang Road Water System Connection	Dawa									0.75							
Zhonghua Road Drainage Channel	Dawa							56.25									
Reconstruction of Flood-prone Areas near the Century Square	Xinglongtai									82.48							
Reconstruction of Flood-prone Areas near the Stadium	Xinglongtai									41.68							
Zhonghua Road drainage pipeline maintenance and renovation project	Xinglongtai									31.64							
Liaohe Middle Road Pump Station Area stormwater and Sewage Diversion Reconstruction Project	Xinglongtai									16.24							
Liaohe South Road Pump Station Reconstruction and stormwater and Sewage Diversion Project	Xinglongtai									20.49							
Xingong Street stormwater and Sewage Diversion Project	Xinglongtai									26.4							
Donghua Road stormwater pipe network and stormwater pump station construction project	Xinglongtai									35.03							
Jinpanhe Street Pumping Station and Upstream stormwater Pipeline Network Reconstruction Project	Shuangtaizi									28.14	5	2	5				
Bayi Pump Station	Shuangtaizi									25.38				3200	22	51	

Reconstruction and stormwater and Sewage Diversion Project																		
Nanqian pump station renovation and stormwater and sewage diversion project	Shuangtaizi										18.9							
Taiping River Pumping Station District stormwater Pipeline Network Reconstruction Project	Shuangtaizi										7							
Gujia Pumping Station Renovation and stormwater and Sewage Diversion Project	Shuangtaizi										172.73							
Gaojia Pumping Station Reconstruction and stormwater and Sewage Diversion Project	Shuangtaizi	Tiedong Sub-district	Gaojia Village	28.5	50	153	New secondary roads, motor vehicle lanes, etc.				13.23					12934	50	153
Huashan Road Sewer Network Renewal in Dawa District	Dawa										18.1							
stormwater and sewage diversion renovation project on main roads in Dawa District	Dawa										52.9							
Tianjia Street Rainwater and Wastewater Separation	Dawa										63.06							
Chunjiang Street stormwater drainage pump station project	Dawa	Dawa Sub-district	Yonghe Community	2.14	1	4	New rainwater pump station	3.62										
Shihua Road South Section (Youyi Street ~ Huancheng South Street) Stormwater Pumping Station and Supporting Project	Xinglongtai							125.96	9	35	1.95							
	Dawa						New rainwater pump station, road, etc.	8.46										
Total				28.5	50	153		204.29	9	35	656.1	5	2	5	16134	72	204	

Note: This data is sourced from the "Resettlement Plan" of this project

7.3.2.2 Other social impacts generated by the project

594. During the construction period, the risk of air pollution comes from dust generated by earthwork excavation, water pipe landfill and other operations, as well as exhaust emissions from construction vehicles; Noise pollution originates from construction equipment and operating processes such as excavators, mixers, and truck transportation; The risk of water pollution is mainly reflected in the potential threat to surface water and residential drinking water. In addition, the influx of a large number of migrant workers may also trigger multiple social impacts, such as security issues, health and hygiene risks, increased resource consumption, and conflicts or misunderstandings caused by cultural differences. These issues may not only affect the lives of residents along the project route, but also exacerbate social conflicts. In terms of transportation, pipeline excavation and the entry and exit of construction vehicles in the construction area may cause road closures, traffic congestion, and the risk of traffic accidents. At the same time, frequent crushing of road surfaces by construction vehicles can increase road safety hazards. Construction delays during the flood season may lead to increased economic losses, incomplete infrastructure affecting residents' lives, and traffic accidents caused by slippery roads on rainy days, further increasing construction pressure.

595. During the operation of the Project, it may face various social risks. First, the employment imbalance may be exacerbated by the increasing demand for professional skills during operation, leading to skill mismatches in the local labor market and limiting employment opportunities for some residents, thereby triggering social problems of employment inequality. Second, conflicts in resource allocation may be exacerbated by the increased demand for water resources, land, energy, and other resources in the Project, especially in situations of resource scarcity or uneven distribution, which may lead to conflicts with local residents or other stakeholders. In addition, the risk of air and noise pollution may be affected by the exhaust gas and continuous noise generated during project operation, which may affect the quality of life of surrounding residents and need to be controlled. In terms of transportation, during the operation of the wetland and ecological restoration component, tourist vehicles may cause road congestion, especially in the vicinity of scenic area entrances and parking lots where traffic flow increases significantly, affecting the safety of local residents' travel. In terms of labor management, the influx of a large number of foreign personnel may pose social security risks. At the same time, wetland maintenance and equipment maintenance during operation involve certain occupational health and safety risks. If workers lack necessary skills training, they may be unable to perform their duties and further cause problems. In addition, insufficient participation of vulnerable groups may pose a risk of uneven distribution of benefits, as they may have difficulty sharing project benefits due to insufficient resources, information, or capabilities; meanwhile, due to geographical or economic limitations, these groups may not be able to fairly access the social resources and services improved by the project. These issues need to be alleviated through reasonable planning and management to achieve sustainable operation and maximize the social benefits of the Project

596. This can be confirmed by the statistical analysis of 500 copies of the questionnaire. Local residents think that the negative impacts that may arise during the implementation of the Project mainly include: a) 88% of the respondents think that the Project will cause pollution from waste gas, wastewater, noise, and solid waste during construction; b) 72.20% of the respondents think that the construction period will cause short-term traffic inconvenience; c) 46% of the respondents think that project construction will have adverse effects on the safety of local lives and property²²; d) 27.80% of the respondents think that the construction period of the Project will lead to soil erosion and water pollution in some river sections outside the urban area of Panjin City 24.60% of project construction will have LAR impacts; e) 2.80% of the residents think that the Project will cause the prevalence of AIDS or other infectious diseases. See Table 7-6 for details.

Table 7-6 Statistical Table of Negative Impact on Residents' Perception during Project

²² The adverse effects on the safety of local people's lives and property mainly include construction safety hazards, traffic safety hazards, the risk of influx of foreign population, the risk of waste disposal, and the safety hazards caused by unmarked hazardous areas. These impacts and mitigation measures have been included in the environmental and social management plan.

Construction and Operation

Indicator category	Possible negative impacts that may arise during the implementation of this project						
Residents' cognitive situation	Pollution caused by exhaust gas, wastewater, noise, and solid waste during the construction period	Short term travel inconvenience caused by construction period	The construction period is not conducive to the safety of local people's lives and property	Causing soil erosion and water pollution in some river sections	The impact of land acquisition and housing demolition	Cause the prevalence of AIDS or other infectious diseases	I don't know
sample size	440	361	230	139	123	14	37
proportion	88%	72.20%	46%	27.80%	24.60%	2.80%	7.40%

7.3.2 Impacts of the Project on community health and safety

597.(1) The Project mostly involves linear works, with a large number of residential buildings, schools, parks and other densely populated areas near the construction sites. During the construction of the 41 components, the frequency of a large number of construction vehicles and dredging vehicles entering and leaving residential areas will increase in the short term, which will cause inconvenience to the travel of residents to and from the community. The entry and exit of construction vehicles into and from residential communities will pose safety risks to residents' traffic. Especially for children and old people who have difficulty walking, their agility in avoiding vehicles is not high, which can easily lead to safety accidents. In addition, mud and debris on vehicles may fall off during the operation of construction vehicles, causing adverse effects on surrounding vehicles and pedestrians. In addition, the dust that permeates the air is not conducive to the respiratory health of pedestrians in the community.

598.(2) During the implementation of the Project, environmental issues such as noise, dust, and exhaust emissions from construction machinery and material transport vehicles, discharge of domestic wastewater during construction, and disposal of domestic waste may have a certain impact on the lives and production of residents in the surrounding area of the Project. As the construction site of the Project involves residential areas with high pedestrian flow in the main city, attention should be paid to the isolation of noise and dust during construction, in order to minimize the impact on surrounding communities/village residents and schools during construction.

599.(3) The construction of the Project also involves the management of rivers within and outside the urban area of Panjin City, as well as the repair of bridges. With the construction and operation of the Project, the landscape along the river will be opened up and facilities will be improved. Pedestrian traffic and traffic in the project area will greatly increase, and the huge traffic flow will pose a potential threat to the personal safety of surrounding villagers, especially to the schools involved in the project area. Safety education should be implemented for students to prevent accidents from happening.

7.4 Gender Analysis

7.4.1 Local women's demographics

600. To promote gender equality and the improvement of women's socioeconomic status, China has established a complete legal framework and policy system. With the important instructions of General Secretary Xi Jinping on the work of women and children as the fundamental compliance, in accordance with the Constitution, the Law of the PRC on the Protection of Women's Rights and Interests, the Labor Law, the Marriage Law, the Electoral Law, the Criminal Law and other relevant laws and regulations, and the overall goals and requirements of the Outline of the Women's Development Plan of China (2021-2030), the Women's Development Plan of Liaoning Province (2021-2030), the Women's Development Plan of Panjin City (2021-2030), 14th Five-Year Plan for

National Economic and Social Development and Vision 2035 of Panjin City, the Project will be implemented within the relevant framework of laws and policies of the PRC, and coordinate women's federations at all levels in the project area to implement specific requirements for the protection of women's rights and interests and gender development.

Table 7-7 Organizational Structure of Women's Federations at All Levels

Level	Affected party
National organization	All-China Women's Federation
Local organizations	Liaoning Provincial Women's Federation
	Panjin Municipal Women's Federation
	Women's Federations of Xinglongtai, Shuangtaizi and Dawa Districts
Grassroots organizations	Women's Federations of Tiedong, Hongqi, Liaohe, Jianshe, Shuangsheng, Shengli, Lujia Town, Tianjia, Dawa, Xinglong, Xinghai, Bohai, Xinggong Street, Zhenxing, Chuangxin, Huibin and Xingsheng Sub-district
	Women's federations of affected communities
Group members	grassroots trade unions and female workers' committees of local affected enterprises

601. According to the Statistical Bulletin on the National Economic and Social Development of Panjin City in 2023, by the end of 2023, the city's permanent population was 1.293 million, including 639,000 males and 653,000 females, with a gender ratio of 98:100.

602. In 2023, the total population of the three project districts was 1.293 million, including 654,000 females, accounting for 50.5%. Among the three project districts, Xinglongtai District had the highest proportion of female population of 50.6%, while Shuangtaizi District had the lowest the proportion of female population of 49.7%. In terms of gender ratio, Shuangtaizi District had the highest gender ratio of 101:100, while those of the other two districts were both 98:100. See the below table.

Table 7-8 Women's Population in the Project Area (2023)

Division	Households (10,000)	Population (10,000)	Males (10,000)	Females (10,000)	Proportion of females (%)	Gender ratio (female=100)
Panjin City	47.8	129.3	63.9	65.3	50.5	98
Project area (covering townships and sub-districts in three districts)	31.5	88	43.5	44.5	50.6	98
Shuangtaizi District	5.3	18.7	9.4	9.3	49.7	101
Xinglongtai District	17.6	44.9	22.2	22.7	50.6	98
Dawa District	14.2	38.6	19.1	19.5	50.5	98

Source: Statistical Bulletin of National Economic and Social Development 2023 of Panjin City.

7.4.2 Local women's current situation

(1) Demographic survey on the sample

603. To learn local women's current situation, the ESIA unit conducted a questionnaire survey and interviews with women. In the questionnaire survey, there are 237 female respondents, accounting for 47.4% of the sample.

604. **Age structure.** In the sample, males and females account for 54.5% and 45.5% respectively. Among the female respondents, those aged 45-54 years are the most (58.3%), followed by those aged 35-44 years (39.4%), and those aged 18-24 years or above are the least (12.7%). See the table below.

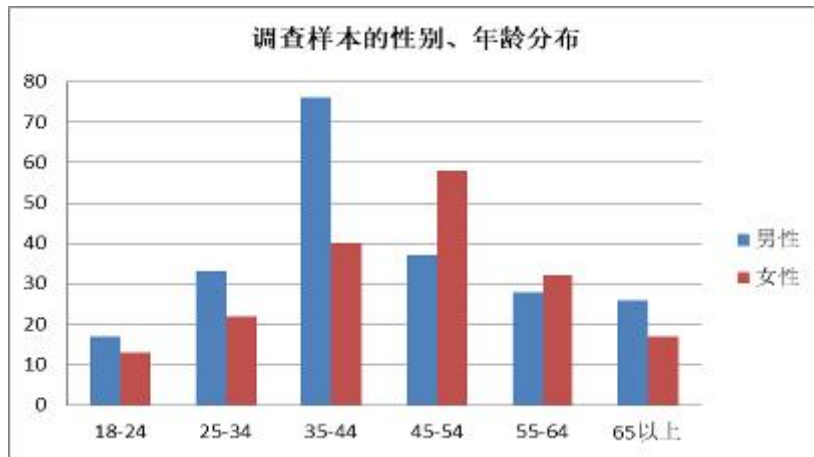


Figure 7-6 Gender and Age Distribution of Survey Samples

605. **Educational levels.** The respondents have mostly received primary high school education (48.95% and 47.91% for males and females respectively). 19.41% of the female respondents have received senior high school / secondary technical school education, lower than that of the males (25.86%). 15.19% of the female respondents have received primary high school education, much higher than that of the males (4.18%). It can be seen that women are generally have lower levels of education.

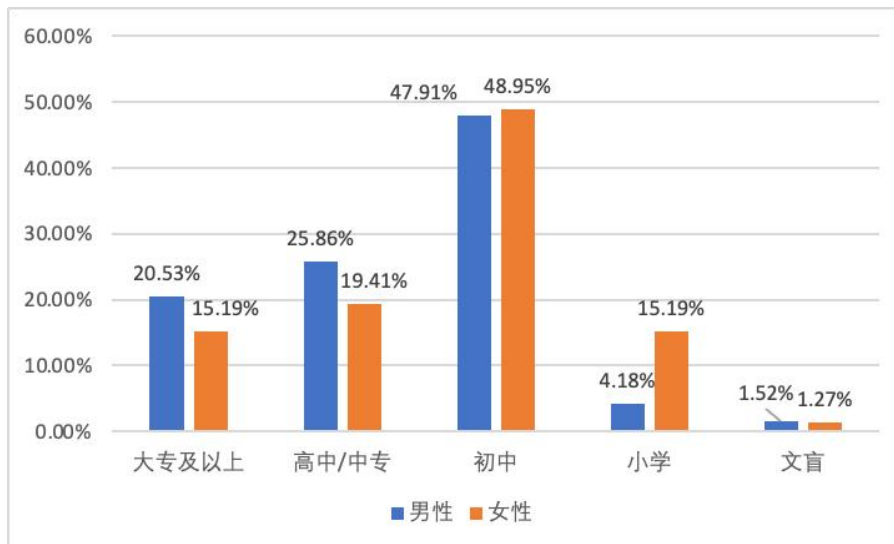


Figure 7-7 Educational levels of survey sample

606. **Occupations.** Over 1/3 of the male and female respondents are civil servants, public institution workers or enterprise employees. The proportion of employment of the males is higher than that of the females, while the proportions of the females choosing “other” and “freelancer” are higher than those of the males. This shows that men and women are relatively balanced in employment.

607. Local women mostly stay at home and rarely work outside. There is a clear division of labor between the genders, where men are responsible mainly for external affairs and women mainly for internal affairs, such as farming and taking care of families. Therefore, men enjoy higher status, while women are mostly subordinate.

Table 7-9 - Gender and Occupational Distribution of Survey Samples

Occupation	Male		Female		Total	
	N	Percent	N	Percent	N	Percent
Civil servant	22	8.37%	15	6.33%	37	7.40%
Public institution worker	46	17.49%	30	12.66%	76	15.20%

Enterprise employee	42	15.97%	31	13.08%	73	14.60%
Self-employer	45	17.11%	31	13.08%	76	15.20%
Freelancer	39	14.83%	47	19.83%	86	17.20%
Student	13	4.94%	22	9.28%	35	7.00%
Retiree	17	6.46%	22	9.28%	39	7.80%
Farmer	19	7.22%	16	6.75%	35	7.00%
Other	20	7.60%	23	9.70%	43	8.60%
Total	263	100%	237	100%	500	100%

(2) Gender differences in the project area (baseline)

608. AIIB-financed projects always focus on gender equality and women's development. ESS1 clearly states the need to identify any adverse gender risks and impacts based on gender factors and develop mitigation measures to reduce these risks and impacts; promote equal opportunities and empowering women's socioeconomic status by optimizing the project design. By referring to the analysis dimensions of gender differences by international financial institutions such as the World Bank and ADB, and combining with the actual situation of the Project, three dimensions of participation in decision-making, economic participation, and development capacity were selected for gender difference analysis.

609. **The proportion of women participating in mobilization, consultation, and decision-making for the Project is lower than that of men.** In the consultation meetings related to the Project, the participation rate of women (41.9%) was lower than that of men (51.2%). The proportion of female respondents (39.3%) who believe they have a better understanding of policies such as LA compensation and noise pollution control implementation standards is also lower than that of male respondents (48.3%). During the interview, it was found that women's recognition and participation rates in the project showed a positive trend.

Interview 7-7: Ms. Chang (38 years old) in Zhenxing Community, Tiedong Sub-district Office

I usually cook, take care of my child and do housework at home. Sometimes, my man goes to meetings and sign documents in the community. Actually, I think there are some things that we women can do, but we don't have the opportunity. We also really want to give our opinions at meetings and hope that the government can give us women some opportunities in

610. **Women's family status is lower than that of men in the project area.** The household income in the project area is still mainly supported by men. The survey results show that men's income accounts for 58.6%, while women's income accounts for only 23.3%. During the interview, it was found that the decision-making power in the family is mainly in the hands of men, while women are limited by lower cultural levels, differences in physiological abilities, heavy household chores, and restrictions on taking care of elderly and children. This has led to many subjective and objective factors restricting women's ability to work outside the home, resulting in significantly lower contributions of women in family economic activities and lower economic status than men.

Interview 7-8: Ms. Zhang (45 years old) and others from Nanqian Community, Jianshe Sub-district

I am currently doing odd jobs. If there is work, I go and do it. If there is no work, I rest at home. If given the opportunity, I would rather transfer my land out and find an easier job with a lower salary, as long as it is stable.

I am currently working in a nearby company and sometimes have to work night shifts. The salary level is a bit unsatisfactory, and the remuneration of our factory is not as good as that of the surrounding factories. I have been thinking about changing jobs recently and still hope for a higher salary.

611. Women have less access to employment information and skills training compared to men. Local rural women face higher employment difficulties than men in the job market, such as significantly lower opportunities for them to obtain employment information (24.7%) compared to men (70.2%), which also reduces their chances of participating in income generating activities (such as creating micro enterprises or joining cooperative organizations). In addition, the heavy household chores and the task of taking care of old people and children also make it difficult for women to participate in various employment skills training activities. Meanwhile, gender bias in the process of information dissemination puts women at a disadvantage in accessing employment and income generating information. In addition, women often shoulder heavy household chores and the responsibility of taking care of the elderly and children in the family, which further compresses their time and energy, making it difficult for them to participate in job skills training and career development activities. This multiple constraint not only limits women's participation in economic activities, but also hinders the diversification of household income and the development of community economy to a certain extent. To effectively address these issues, policy support and social advocacy are needed to alleviate women's family burdens, promote gender equality, and enhance women's ability and opportunities to participate in economic activities.

Table 7-10-- Analysis of Gender Differences

No.	Option	Male	Female	No gender difference / joint participation	Difference analysis	Remarks	Dimension
1	Who attends community mobilization and consultation meetings on the Project?	51.20%	41.90%	6.90%	The proportion of female attendees is much lower than that of male attendees.	Female respondents have strong willingness to attend meetings.	Participation in decision-making
2	Which family member is more familiar with policies such as LA compensation and standards for noise pollution control?	48.30%	39.30%	12.40%	Women are less familiar with policies than men.	It is necessary to increase women's familiarity with policies related to the Project.	
3	Which gender has more information on job opportunities (business and skills)?	70.20%	24.70%	5.10%	The probability of men obtaining employment information is much higher than that of women.	Increase the promotion of business information and skills training for women.	
4	Which gender has more income?	58.60%	23.30%	18.10%	Men's income is higher than that of women.	Increase women's income.	Economic participation
5	Do women face employment	36.50%	63.50%	/	Women are more difficult in getting	Make jobs first available to	

difficulties?				employed.	women.	
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7.4.3 Impacts of the Project on women

(1) Positive impacts

612. **Provide job opportunities for women and increase economic income.** During project construction, it is expected to provide 130 temporary jobs for women, such as unskilled laborers, cleaners, traffic maintenance personnel, and cooks. These nearby temporary jobs can be provided to young and middle-aged women and low-income residents, allowing local women and low-income residents to increase nonagricultural economic income; after the completion of the Project, a certain number of unskilled jobs (24) will be provided, such as cleaners, patrol officers, and security personnel. Priority will be given to low-income residents and women with work needs among the affected local residents, ensuring that low-income residents increase their economic income. In addition, the implementation of the Project will also promote the export of characteristic products and the development of tourism in Panjin City, and have a positive effect on increasing the income of women’s families in the project area.

613. **Encourage women’s participation and promote their own development.** The Project encourages women’s participation in the project and pays attention to the protection of women’s rights. In the process of project construction and implementation, leveraging existing community and village committees can promote women’s participation in relevant public affairs, encourage women to participate in project discussions and consultation forums. Enable more women to learn and participate in the Project, giving them full voice, expressing their own needs, and striving for more development opportunities. In addition, providing safety awareness training and employment training for women will also be beneficial in improving their comprehensive quality and promoting their long-term development. The fieldwork has found that women are more willing to participate in public activities, and community public participation in sports can prioritize the participation of female groups.

614. **Provide women with a more comfortable and convenient travel environment.** The implementation of the Project will also promote the improvement and supporting of public infrastructure such as catering, accommodation and trade centers, reduce the transport and time for Local women to travel, shop, work, etc., and improve the travel experience.

(2) Negative impacts

615. The fieldwork has found that 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 needs and suggestions for the project are ignored, it will reduce project benefits and bring certain social risks to women, as detailed below:

616. **Women’s needs are more likely to be overlooked.** In the project area, due to factors such as traditional social culture and economic dominance, the social status of women is still lower than that of men. In major family affairs, men make the majority of decisions and participate in public affairs. In this way, it often leads to the neglect of women’s specific needs and related suggestions in project design, implementation, and operation management, resulting in insufficient attention to women’s needs in the Project, which can easily lead to the neglect of women’s relevant needs.

617. **Potential GBV risks.** GBV is any harmful behavior that violates individual will and is based on social attribution of gender differences between individuals. It includes acts that cause physical, sexual, or mental harm or suffering, or involve threats, coercion, and other deprivation of liberty related to such acts. These behaviors can occur publicly or privately. During project implementation and operation, the proportion of male workers was much higher than that of females, and male workers tended to be more inclined towards technical and managerial positions. If not managed properly, harmful behaviors such as GBV, sexual exploitation and abuse, and sexual harassment may occur, which may have a negative impact on the physical and mental health of female workers on construction sites and institutions.

7.4.4 Responding Measures

618. In summary, the ESIA survey team has compiled some concentrated needs of the female population in the project area based on questionnaire surveys of sampled samples, women's FGDs, in-depth interviews, and field visits. In response to these needs, the following action suggestions are proposed.

(1) Increasing employment opportunities for women:

a. During the construction and operation of the Project, make skilled and unskilled jobs first available to women in the affected villages and groups.

b. For jobs that do not require high physical strength, ease the employment age range appropriately, and give priority to women aged 40 to 50 who have difficulty finding nonagricultural jobs, such as cleaning, inspection and management.

(2) Enhancing women's development capacity:

a. By organizing employment knowledge lectures, skill knowledge training courses, and employment entrepreneurship seminars, enhance women's skills, knowledge, and opportunities in employment and entrepreneurship.

b. In flood prevention and disaster reduction training and sustainable information disclosure capacity building training, provide appropriate skill training based on factors such as women's physiological and psychological qualities, education level, and personal needs, and set appropriate training time to further ensure that women have equal opportunities with men to improve their skills.

(3) Expanding women's participation in decision-making:

a. Increase the proportion of women participating in decision-making related to community affairs;

b. Increase the proportion of women signing or LA or HD compensation agreements.

(4) Reducing GBV risks:

a. Strengthen the protection of the rights and interests of female workers, and provide regular psychological counseling and training on the protection of their rights and interests;

b. Strengthen the supervision of construction sites to avoid harmful behaviors such as GVB, sexual exploitation and abuse, and sexual harassment;

c. Establish clear grievance redress channels, set up a construction site grievance redress team, which should include at least two female members, and ensure the safety of the members of the grievance redress team to avoid bias and fear of retaliation.

7.5 Current situation of poverty

619. After the precise poverty alleviation and poverty alleviation campaign, by 2023, there was no poor village, household or resident in the 3 project districts, and absolute poverty was historically eliminated. However, poverty may still exist. The poor population mentioned here is equivalent to the low-income population, mostly lifted out of poverty in 2021²³.

7.5.1 Current situation of local poverty

620. Panjin City adopts the urban-rural integration assistance standard and does not differentiate between urban and rural areas. In 2023, there was no poor village, household or resident in the 3 districts according to the prevailing current standard. By district, the current situation of the low-income population is as follows:

(1) Shuangtaizi District: As of the end of 2023, the total population of the district was 187,000, including a low-income population of 2,825, accounting for 1.51% of the district's total population;

(2) Xinglongtai District: As of the end of 2023, the total population of the district was 449,000, including a low-income population of 1,673, accounting for 0.37% of the district's total population;

²³Poor population: At the end of 2021, there was no poor village in the project area. However, poverty may still exist.

(3) Dawa District: As of the end of 2023, the total population of the district was 420,000, including a low-income population of 3,931, accounting for 0.79% of the district's total population.

Table 7-11 Profile of Local Low-income residents (10,000)

District	Total population	Low-income residents	Proportion
Shuangtaizi District	18.7	0.2825	1.51%
Xinglongtai District	44.9	0.1673	0.37%
Dawa District	42	0.3931	0.93%
Total (project area)	105.6	0.8429	0.79%

Source: Statistical data provided by the Panjin Municipal Civil Affairs Bureau.

7.5.2 Livelihood patterns of low-income population

621. Low-income residents in the project area deal with self-sufficient small-scale farming, including:

(1) The income source is narrow, mainly relying on traditional agriculture. For low-income residents, their sources of income and livelihood models are single and limited. According to the data from the questionnaire survey, 70.52% of low-income residents' income is mainly from agriculture and stockbreeding. The average proportion of agricultural planting income to household income for low-income residents is 63.5%. This indicates that low-income residents still rely heavily on agricultural cultivation as their main source of income, and their dependence on traditional agricultural income is very high.

(2) The business model is single, mainly based on traditional agriculture and traditional agricultural management models. Through discussions and interviews, it can be found that on the one hand, low-income residents still rely mainly on traditional agricultural cultivation such as growing food, with less cultivation of economic crops. Survey data shows that 89.82% of low-income people grow rice in their farmland, 5.38% grow corn, only 0.2% grow soybeans, and 4.6% grow other crops such as vegetables. On the other hand, low-income residents generally has a low level of education and is older in age (men over 50 years old and women over 45 years old). They find it difficult to accept new things such as agricultural technology and information technology, and lack the necessary skills to improve their lives. Therefore, traditional production methods are still the mainstay of agricultural planting, and modern mechanical technology is rarely used. The proportion of cooperative participation is also not high.

Table 7-12 Crops Cultivated by Low-income residents

Crop	Frequency (HH)	Percentage (%)
Rice	2656	89.82
Corn	159	5.38
Soybean	6	0.20
Vegetables and other crops	136	4.60
Total	2958	100

Note: According to data provided by the Panjin Municipal Civil Affairs Bureau, the land planting in the project area is done twice a year. Here, the statistics show the main types of crops planted by 2958 low-income households in the project area within a year, highlighting the single source of agricultural income structure and the difficulty of increasing income through traditional agriculture.

7.5.3 Poverty causes of low-income residents

622.(1) **Lack of variety in economic structure.** The economic structure of Panjin City heavily relies on the petroleum industry. As an important petroleum resource city in China, Panjin's petrochemical and energy industries account for a significant proportion. However, resource-based industries are susceptible to fluctuations in international oil prices and slow technological upgrades, resulting in a relatively single economic structure and a lack of diversity. This dependence makes Panjin's economy prone to fluctuations, and resource-based industries often lack the ability to create a large number of job opportunities, especially for unskilled labor. With the global transformation of the energy industry, the traditional oil industry is gradually shrinking or facing challenges, resulting in some low-income residents being unable to adapt to changes in the

industrial structure and lacking effective job opportunities.

623.(2) Limited business models. First, Panjin City mainly relies on rice paddy agriculture, with a relatively single planting structure. Low-income residents lack diversified crop planting techniques and agricultural products. Due to the focus on rice cultivation, most land and water resources are concentrated for rice production, and the development of other agricultural industries is relatively lagging behind, making it difficult to achieve industrial diversification. Second, farmers mainly engage in traditional family style operations, with a low degree of scale and intensive management. The application of modern agricultural technology and facility agriculture is insufficient, resulting in relatively low production efficiency and low industrial added value. In addition, the extension of the agricultural industry chain is insufficient, and the processing, packaging, and brand building of the rice industry are relatively weak. The agricultural added value is low, the market competitiveness is insufficient, and the income of farmers is limited. Although Panjin City has advantages in traditional industries such as energy and petrochemicals, these industries often have low demand for labor and high requirements for skilled workers. Many low-income residents lack corresponding skills and find it difficult to enter high paying positions. Due to the lack of high-tech emerging industries and limited opportunities for innovation and entrepreneurship, unskilled laborers lack competitiveness in the labor market. In addition, the intensive development of industry often leads to an increase in automation, reducing the demand for unskilled workers and further exacerbating the employment problem for low-income residents.

624.(3) The phenomenon of poverty arising from disability due to illness is prominent. Being disabled due to illness is the main reason for the low income of low-income residents. Some low-income individuals in this group have lost their ability to work and rely on subsistence allowances for survival, while others have become impoverished due to illness and borrowed money for medical treatment, resulting in a high debt burden.

625.(4) Sudden poverty arising from disasters. The urban waterlogging in Panjin City has caused some farmers' farmland to be washed away, resulting in serious property losses (such as farmland and production materials), which has dealt a double blow to the already low-income residents. The relevant rescue and assistance measures have not kept up in a timely manner, directly or indirectly leading to the plight of low-income residents.

626.(5) The endogenous motivation of low-income residents is not sufficiently stimulated. Part of low-income residents has a serious mentality of reliance, and their awareness of poverty alleviation and wealth creation is weak. They are unwilling, afraid, and unable to lift themselves out of poverty. There is not much innovation in the ways and methods of assistance, and there are few ways and means to stimulate the endogenous motivation of low-income residents.

7.5.4 Low-income residents' needs for the Project

627. Based on the above analysis of the local low-income population, it can be seen that the Project will affect and serve 2,958 low-income households. Therefore, it is necessary to consider meeting the special needs of this group, consider their good suggestions, and avoid the potential negative impacts of the Project on their production and lives, in order to truly meet their collective needs, serve this group well, and play a positive role in stabilizing their wealth.

628. Therefore, the ESIA unit conducted fieldwork, including organizational interviews, village committee FGDs, interviews with low-income residents, and questionnaire survey, to gain a comprehensive understanding of their needs for the Project. It is found that this group's main demand for the Project is that the Project can bring them job opportunities.

629. They expect priority access to job opportunities and jobs. From the analysis of the FGD and questionnaire survey, it was found that 92% of low-income residents expressed the hope that the project could provide them with some job positions and increase their sources of income. Low-income individuals themselves come from relatively poor families, and some of them also have disabilities, making employment more difficult; So they urgently need job opportunities that can absorb them, and it is best to prioritize the poor when recruiting, in order to support their families and increase their economic income. During the construction and later operation of the Project,

there will be some unskilled jobs, such as cleaners, patrol officers, and security guards at the management stations along the Liaohe and Yitong Rivers. If these job positions are suitable, they can be prioritized for poor residents.

7.5 Impacts of the Project on low-income residents

630. The potential negative impacts of the Project on poverty alleviation and the creation of new poverty mainly include: the project involves LAR, and relatively low-income communities and populations are often at a disadvantage in terms of compensation and resettlement, obtaining project benefits, and actively adapting to transformation, which may exacerbate the low-income problem between regions and within communities; after the completion of the Project, it may cause an increase in local price levels, bringing daily consumption pressure to low-income residents.

631. But according to the planning and design principles of the Project and subsequent safeguard measures, it will ensure that the implementation of the Project will not deepen the poverty level in low-income areas or lead to new poverty, and enable low-income residents to benefit equally from the project and lift themselves out of poverty. Specifically manifested in:

(1) Provide direct and indirect job opportunities to increase economic income. During the construction and implementation of the Project, especially in the fields of infrastructure construction and ecological restoration, a large number of job opportunities have been created. These positions cover various occupational categories such as construction workers, maintenance personnel, green maintenance, logistics and transport. For low-income residents, these positions provide a relatively stable source of income, helping them improve their family's financial situation. The Project significantly increases the economic income of the local low-income residents by providing direct and indirect job opportunities, helping them improve their living conditions. Direct job opportunities are mainly reflected in the demand for labor during project implementation, especially in projects such as drainage infrastructure construction, ecological restoration, and river slope protection. Construction workers, machinery operators, construction managers, and other positions directly target local residents, especially low-income residents. These job positions provide stable wage income, enabling low-income families to rely on labor for sustained economic support and alleviate life pressure. Indirect job opportunities are generated through the driving effect of the industrial chain. The implementation of the Project has driven the growth of demand in related industries, such as building material supply, equipment maintenance, logistics transport, etc., creating more business opportunities for small businesses and individual businesses in the surrounding areas. In addition, with the improvement of the ecological environment and the enhancement of urban infrastructure, the Project will help promote the development of service industries such as tourism, catering, and retail. The prosperity of these industries has provided more part-time or full-time job opportunities for low-income residents. During the implementation of the Project, priority will be given to providing job opportunities for low-income residents. Panjin City will reduce the unemployment risk of low-income residents through policy incentives and relevant subsidy measures. In addition, the Project has a long cycle and can provide them with sustained employment security, thereby alleviating the problems of income instability and lack of job opportunities. This not only increases the economic income of low-income families, but also enhances their ability to resist risks in face of sudden economic difficulties.

(2) Promote equalization of public service resources. The Project upgrades infrastructure, such as the reconstruction of sewer networks, the addition of ecological shorelines, the construction of bridges, and the updating of lighting systems, bringing convenience to the daily lives of low-income residents, shortening their commuting time, and improving traffic safety. In addition, the implementation of the Project has promoted the rational allocation of public resources, enabling low-income residents to enjoy more equal public services. For example, the government can provide job opportunities and various subsidy policies through projects to further ensure the basic living needs of low-income residents, including job stability subsidies, vocational training subsidies, etc. These policy support measures provide more survival guarantees for low-income residents, enabling them to live and work more comfortably and gradually improve their living standards.

(3) Promote local economic development and increase development opportunities. The Project has effectively promoted the development of local economy and created more development

opportunities by improving infrastructure, optimizing ecological environment, and enhancing urban functions. First, drainage facility improvement, river slope protection, and ecological restoration will greatly enhance the city's ability to resist disasters, and reduce economic losses arising from floods and waterlogging. Safe and reliable infrastructure will attract more investors and businesses, especially in the fields of environmental protection and green development, injecting new impetus into the local economy.

632. Second, the Project has created a large number of job opportunities during the construction and operation periods, directly increasing residents' income, improving consumption levels, and further promoting the prosperity of the local economy. Low-income residents obtain income and improve their living standards through employment, thereby promoting the growth of demand for local service industries such as retail and catering, forming a virtuous economic cycle.

633. In addition, the Project will drive the development of green industries and promote the rise of ecotourism, green agriculture, and urban leisure industries. For example, the construction of ecological wetlands can not only improve environmental quality, but also attract investment from tourism and related service industries, further expanding opportunities for local economic development. Therefore, the Project promotes the diversified development of the local economy through the improvement of infrastructure and environment, laying a solid foundation for the sustainable development of the region.

7.5.6 Local supporting measures

634. In general, the local supporting measures include:

(1) Focusing on strengthening industrial assistance. Panjin City is based on its agricultural resource endowment and industrial foundation advantages, focusing on cultivating large bases, large enterprises, and large industries, actively building a modern agricultural full industry chain system, leading high-quality development with refined agriculture, and striving to be the first in the province to build a modern large-scale agricultural pioneer in facility, park, integration, greening, and digitization. To this end, Panjin City has issued a three-year action plan with the development of modern agriculture as the main direction, actively building the "322" modern agriculture full industry chain system, namely accelerating the construction of three million mu production bases for rice crab symbiosis, reed field fishery, and marine pasture, two billion level industrial clusters for japonica rice and soybeans, and two billion level distribution centers for agricultural products in the Xinfadi region and river crabs in northern China; Provide job opportunities, vigorously develop rural collective economy, implement collective economic projects, and drive low-income residents to lift themselves out of poverty and become prosperous.

(2) Emphasizing the importance of providing employment assistance. Panjin City actively promotes equal employment services, and rural workers can register as unemployed in their urban permanent residence and enjoy urban employment services. Develop county-level economy, rural tourism, etc., to create job opportunities for rural workers. Provide job referral subsidies to eligible labor export agencies. Implement poverty alleviation through rural employment, develop public positions at the village level to resettle those who have difficulty finding employment, and encourage migrant workers returning to their hometowns to establish small and micro enterprises to absorb job opportunities and enjoy job subsidies. Encourage financial institutions to support enterprises and rural economic entities that drive employment, and promote employment in impoverished areas. Improve the long-term mechanism of employment assistance, provide classified assistance and dynamic management for individuals facing employment difficulties, implement social security and public welfare job subsidies, and ensure that at least one person from disadvantaged families has stable employment. Improve the gradual withdrawal system of subsistence allowances, enhance employment stability, and ensure job opportunities for vulnerable groups in society. Actively guide the poverty-stricken population and monitoring objects with labor capacity to achieve employment through various means such as enterprise recruitment, public welfare positions, flexible home stay, and self-employment. By setting up job substitution assistance positions, we aim to provide job opportunities for capable poverty-stricken individuals and monitoring targets who find it difficult to find employment in the short term.

(3) Preventing re-improvement due to disasters. Panjin City has implemented 78 post-disaster recovery and reconstruction projects in the agricultural sector, promoted the restoration of agricultural production order, with a total area of 7,805 mu of crops replanted, and granted temporary relief funds of 65.38 million yuan.

(4) Continuously increasing investment in infrastructure. Panjin City actively promotes the connectivity among administrative villages and natural villages and groups, implemented the rural power grid reconstruction and upgrading project vigorously, carried out the special rectification action of the rural living environment, and established a long-term mechanism for daily cleaning of rural domestic waste, eliminating dry toilets, black and odorous water bodies, and garbage piles, greatly improving the production and living environment of residents.

7.6 Ethnic minority population in the project area

635. The Panjin PMO, PIUs, and ESIA unit conducted a special on-site survey on ethnic minorities during July 9-17, 2024, and a series of public participation activities. According to the identification criteria determined by ESS3 in AIIB's ESF, a detailed understanding of the population, ethnic composition, identification of ethnic minority villages, and whether ethnic minorities are concentrated in each project area has been obtained.

636. The beneficiary area of the Project involves 17 townships / sub-districts in Shuangtaizi, Xinglongtai and Dawa Districts, Panjin City. The direct beneficiary population along the three project districts is about 879,914 people, including 731 minority residents.

637. Among them, the main ethnic minority are the scattered and mixed Korean ethnic group (accounting for 99.79% of the minority population in the project area), and the Mongolian ethnic group accounts for 0.003% of the total population. There is no ethnic minority population living centrally in the project area. The minority population is small and scattered, and is most composed of Korean and Mongolian people who entered the project area due to marriage or job transfers.

638. Minority residents 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 in the project area - the Han ethnic group.

639. Minority residents are indirect beneficiaries of the Project, rather than directly affected persons. The Project will have almost no negative impact on them.

Table 7-13 Screening Table for Ethnic Minorities in the Project Area

Chapter 7 Social Impact and Risk Analysis and Mitigation Measures

City	District	Township / sub-district	Population	Ethnic minority population	Proportion of ethnic minority population (%)	Composition of ethnic minority population
Panjin City	Xinglongtai District	Xinglong Sub-district	55961	72	0.13	Korean, Mongolian
		Xinghai Sub-district	54718	62	0.11	Korean
		Bohai Sub-district	61900	68	0.11	Korean
		Xingong Sub-district	17446	21	0.12	Korean
		Zhenxing Sub-district	56420	60	0.11	Korean
		Innovation Sub-district	52410	64	0.12	Korean, Mongolian
		Huibin Sub-district	73155	88	0.12	Korean
	Shuangtaizi District	Xingsheng Sub-district	83215	96	0.12	Korean, Hui
		Tiedong Sub-district	22331	17	0.08	Korean
		Hongqi Sub-district	19333	7	0.04	Korean, Mongolian
		Liaohu Sub-district	38865	18	0.05	Korean
		Jianshe Sub-district	47316	29	0.06	Korean
		Shuangsheng Sub-district	20043	21	0.10	Korean
	Dawa District	Shengli Sub-district	40949	16	0.04	Korean
		Lujia Town Government	7717	2	0.03	Korean
		Tianjia Sub-district	160000	67	0.04	Korean, Mongolian
		Dawa Sub-district	68135	23	0.03	Korean
	total	seventeen	879914	731	0.08	

Source: Statistical reports on national economic and social development of the project districts, as well as data from the ethnic and religious affairs bureaus

640. The survey on ethnic minority identification found that:

Table 7-14 Identification of Ethnic Minorities (ESS3)

Identification criteria	Yes	No	Remarks
1. Are they self-identified as members of a unique indigenous cultural group and recognized by others?		X	All respondents, including those of ethnic minorities and Han, think that there is no difference between the local ethnic minorities and the Han ethnic group, and they are completely integrated with the Han people.
2. Are they collectively attached to a geographically distinct habitat or ancestral estate within the project area, and natural resources of such habitat and estate?		X	
3. Customary cultural, economic, social or political institutions that differ from mainstream society and culture;		X	
4. A unique language that is usually different from the official language of the country or region.		X	They don't have their own language and roles. They speak the local dialect and Mandarin Chinese, and are fully integrated with the Han people.

(1) There is no ethnic minority that triggers ESS3 in the project area.

(2) There is no centrally living ethnic minority population, traditional estate, ethnic minority language or traditional culture, or self-identified ethnic minority within the project area.

641. Therefore, there is no need to develop an ethnic minority development plan for the Project.

8 Stakeholder Engagement

8.1 Stakeholders identification

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

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

8.1.1 Primary stakeholders

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

645.1) Beneficiaries: The Project will benefit residents along the project in 17 sub-districts in 3 districts, Panjin City (mainly including local residents, women, old people, low-income residents, and school teachers and students). In addition, the Project will promote the economic and social development of 17 sub-district offices and townships in the project area, and benefit 879,914 people in the project area, including 444,914 females, accounting for about 50.56% of the total population. The beneficiaries of each district are shown in Table 8-1 below.

646.a) Local residents: Local residents are the most direct beneficiaries of the Project, and the Project will benefit about 879,914 residents in the three project districts. As an old industrial city, Panjin City is constantly updating and developing, and the existing problems are gradually becoming apparent. The development of oil fields and other industrial constructions will inevitably lead to isolation and fragmentation of estuarine wetlands, as well as wetland shrinkage and severe degradation of ecological wetlands. In addition, agricultural activities such as development have damaged and silted up the water channels connecting local paddy fields and wetlands, leading to a decline in the functionality of water system connectivity. The low-lying areas near Century Square and the stadium are prone to serious waterlogging during rainfall, making them typical flood prone areas that directly affect residents' traffic during the rainy season and even threaten their life and property safety. The main impacts that the Project will bring to the nearby residents are as follows (see Section 7.3 for specific component impact analysis):

647. First, through the connection of drainage systems and ecological restoration, the rational planning and management of water systems can enhance regional flood control and disaster resistance capabilities, improve water quality, and restore the ecological balance of natural water bodies. Ecological wetland restoration projects enhance the ecological service capacity of wetlands by restoring or improving their ecological functions. Ecological shoreline construction aims to restore natural riverbanks, control riverbank erosion, improve river health, and enhance the ecological functions of rivers. The construction of urban green space source emission reduction can reduce urban rainwater runoff, improve air quality, and alleviate urban heat island effect by increasing green space area, constructing rain gardens, and infiltrating green spaces.

648. Second, in the long run, the construction of sewer networks and pump stations will significantly enhance the city's ability to cope with climate change and extreme weather, reducing the economic and social losses arising from waterlogging. Although these facilities may not be visually prominent, their functionality is crucial in daily life.

649. Third, with the advancement and implementation of the Project, it will enhance the land value within Panjin City, beautify the scenery along the Yitong River, Liaohe River, Pangxie Ditch, Qingshui River, Zhaoquan River and their tributaries, beautify the urban landscape, and enrich the spiritual and cultural life of local residents.

650. Finally, the Project will bring spiritual consolation to local residents, increase the city's

commerce and tourism income, improve the city's influence, and generate job opportunities for local residents.

Table 8-1 Overview of Beneficiary Population in the Project Area

City	District	Township / sub-district	Population	Female beneficiary population	Proportion of female beneficiaries (%)
Panjin City	Xinglongtai District	Xinglong Sub-district	55961	29189	52.16
		Xinghai Sub-district	54718	27917	51.02
		Bohai Sub-district	61900	30114	48.65
		Xingong Sub-district	17446	8667	49.68
		Zhenxing Sub-district	56420	28904	51.23
		Innovation Sub-district	52410	27547	52.56
		Huibin Sub-district	73155	36504	49.9
	Shuangtaizi District	Xingsheng Sub-district	83215	41907	50.36
		Tiedong Sub-district	22331	12038	53.91
		Hongqi Sub-district	19333	9481	49.04
		Liaohu Sub-district	38865	19885	51.16
		Jianshe Sub-district	47316	23477	49.62
		Shuangsheng Sub-district	20043	10401	51.89
		Shengli Sub-district	40949	20306	49.5
	Dawa District	Lujia Town	7717	3848	49.86
		Tianjia Sub-district	160000	80832	50.52
	Total	Dawa Sub-district	68135	33897	49.75
		17	879914	444914	50.56

Source: district governments, 2023 local township socioeconomic statistical reports.

651.b)Vulnerable groups: Vulnerable groups in the project area refer to MLS households, five-guarantee households, disabled people, women-headed households, low-income residents, etc. (but among the 244 people affected by LAR, there is no relevant vulnerable group). These people are relatively vulnerable groups, and their interests and demands need to be taken seriously. The Project will undoubtedly bring more job opportunities and convenient and pleasant water system and wetland environment to the local area. The construction of infrastructure such as rainwater and wastewater pipelines, ecological wetlands, and landscape beautification along rivers will generate unskilled jobs such as security guards and cleaners, which will be prioritized for local vulnerable groups to achieve on-site employment. This way, these vulnerable groups can take care of their families and have stable income.

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

653.The Project's LAR impacts arise from LA related to river management, affecting 83 households with 244 people (including 9 households with 35 people affected by the occupation of state-owned land) in Shuangtaizi, Xinglongtai and Dawa Districts, Panjin City. For specific details, please refer to the RAP for the Project.

8.1.2Secondary stakeholders

654.The secondary stakeholders of the Project include: the project owners; design agency, contractors, supervising agency, etc.; the government and its related functional departments.

655.(1) Panjin PMO. Since December 2023, the Panjin Municipal Government has established the Panjin PMO, which is fully responsible for the organization, leadership, management, implementation, supervision and guidance of the Project, and is responsible for liaising with provincial authorities and AIIB. Xinglongtai and Shuangtaizi Districts, Panjin City have both established project leading groups, responsible for organizing and coordinating the Project. The project team is composed of elite personnel selected from the housing and urban rural development bureau, finance bureau (state-owned assets supervision and administration commission), natural resources and planning bureau, emergency bureau, ecology and environment bureau, and three

district governments. They are responsible for the construction and management of local subcomponents, with the aim of overall coordination and inter departmental cooperation within their jurisdiction under the unified coordination and guidance of the Panjin Municipal Government, and promoting the smooth implementation of the Projects.

656.(2) Owners. The project owners (PMCC, SDHURDB, XDHURDB and DDHURDB) serve as the construction and operation agencies of the Project, responsible for coordinating business relationships among all parties and organizing and managing the construction of the Project.

657.(3) Government and its related functional departments. The government departments involved in the Project mainly include urban and rural construction bureaus, natural resources and planning bureaus, county-level/district-level House Expropriation Affair Center, development and reform bureaus, transport bureaus, statistics bureaus, human resources and social security bureaus, women's federations, civil affairs bureaus, ecology and environment bureaus, sub-district offices, etc.; in addition, the implementation of the Project also involves grassroots staff of specific communities/village committees in the project area. The successful implementation of the Project relies on their support.

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

8.2 Analysis of stakeholder needs in the project area

(1) Flood prone areas in the urban area affect residents' daily traffic, and there is an urgent need for comprehensive infrastructure reconstruction.

659. The merging of rainwater and wastewater in the urban center of Panjin has caused serious overflow pollution. The drainage system in most areas of the main urban area is an intercepting combined system, although the problem of wastewater entering the river during the dry season has been basically solved; but during the rainy season, rainwater causes wastewater overflow, which directly flows into existing rivers and wetlands, causing serious pollution to the water environment and even threatening water ecological health. Especially in low-lying areas such as Century Square and around the stadium, heavy rains can easily lead to severe waterlogging, which is a typical flood prone point that directly affects residents' traffic during the rainy season and even threatens their health. Residents urgently need to reduce road waterlogging sites and floods. Residents hope that through the construction of the Project, the accumulation of water during flood and rainy seasons can be effectively reduced, and the impact on production and daily life can be minimized. The main demands are concentrated in the following areas:

a) Enhance the connectivity of water systems, reduce impacts of floods on residential environments, and ensure public health and safety.

660. The construction of drainage systems in Panjin City dates back a long time and has low design standards. Residents in Dongshan and Majuanzi Communities have expressed that heavy rain often leads to water accumulation on roads, especially in low-lying areas of the community. First floor residents are very worried that the accumulated water will flow back into the residential building, affecting their normal life and even causing damage to houses and appliances. Therefore, residents hope to improve the capacity and efficiency of the urban drainage system to avoid flooding during the flood season and ensure that their houses and property are not damaged by floods. In addition, residents hope that the drainage system can be reconstructed as soon as possible to avoid the situation of waterlogging when it rains, as well as the risk of road icing and slipping due to low winter temperatures and water seepage, which greatly affects traffic safety.

661. The low-lying water accumulation arising from the merging of rain and wastewater may also lead to the overflow of wastewater from the sewer, polluting the environment. Accumulated water is prone to breeding bacteria, germs, and mosquitoes, which can affect the health of residents, especially those with weaker immune systems such as old people and children. Therefore, residents hope to reduce the risk of wastewater overflow during the flood season and ensure environmental hygiene during floods by improving the city's rainwater and wastewater separation

system. In addition, residents also hope that disinfection and sterilization measures can be taken in time to prevent mosquitoes and germs from breeding in stagnant water and protect the public health of the community.

Interview 8-1: Mr. Song, etc. (56 years old) in Jinhe Community, Xingsheng Sub-district

Xingyou Street always emits water when it rains. It's not usually blocked, but when it rains, it is blocked and emits wastewater. Rainwater and wastewater mix together and are directly discharged into the Pangxie Ditch, surrounded by a foul smell.

When water comes out in winter, the road is filled with ice blocks, and I can't even get out of the door. Last year, I broke my hand bones on the road because the ice was too slippery. I don't know who to seek help from if I fell. The sewer network must be completed soon, otherwise it's not convenient or safe to go out in winter.

Interview 8-2: Mr. Qi (43 years old) in Tianjia Sub-district, Dawa District

We think it should be built into a scenic river as much as possible, and river water should be as clear as possible. It's better in winter now, but in summer, there are often groups of small flying insects and smelly water next to the river, and it doesn't smell good when we walk beside the river.

I think the riverside landscape should be integrated with the surrounding ecological environment. There are many tourist attractions here, and it would be great if we could improve the water environment and infrastructure of the river.

b) Improve river infrastructure to ensure the traffic safety of residents.

662. The guardrails in the Pangxie Ditch are relatively simple, and the falling bricks at the river border have various adverse effects on residents' traffic. Residents often take walks near the river. The safety functions of guardrails and border defense have failed, especially posing a greater risk to old people and children; at night or in adverse weather conditions, low visibility increases the risk of accidental falls into rivers, which can seriously endanger life. In addition, rudimentary river guardrails and unstable slopes can also increase residents' sense of insecurity, thereby affecting daily traffic; especially for pedestrians and cyclists who need to frequently pass through the Pangxie Ditch, they have to choose detours, which increases commuting time and costs. Therefore, it is hoped that the Project can be implemented as soon as possible, improve the river infrastructure, ensure traffic safety, which is very important for the residents living along lines.

Interview 8-3: Mr. Li, etc. (52 years old) in Xingsheng Community, Xingsheng Sub-district

The guardrail next to the Pangxie Ditch is very rudimentary, and some bricks have fallen off. It needs to be reinforced, and it is particularly unsafe for old people to take a walk there.

The small bridge over the Pangxie Ditch in winter is particularly slippery after snowfall. Sometimes when it rains, I dare not pass through it by bike, so I should use some anti-skid steel plates to prevent slipping.

Stones on the anti-blocking wall of the pump station fall off and tilt gradually every year. People are afraid when walking beside it, because they feel like it is about to collapse. It really needs to be repaired soon.

c) Ensure smooth daily commuting, avoid public transport interruptions, and improve traffic convenience.

663. Frequent urban waterlogging and weak resistance to climate change. The road surface water arising from waterlogging can lead to traffic congestion, affecting residents' normal commuting to and from work, and may even delay the handling of emergency situations. Residents expect to improve the drainage system, quickly remove accumulated water from roads, and ensure the smooth flow of traffic arteries, especially during peak commuting periods and near main roads, to ensure smooth transport for commuting, commuting, and school. In addition, we hope to have reasonable traffic guidance and diversion plans during extreme weather periods to reduce impacts of traffic congestion on daily life. Especially during the flood season, emergency measures are needed to ensure the normal passage of public transport, especially during peak hours and emergency situations, which can guarantee the safety of important transport routes

Interview 8-4: Ms. Zhang, etc. (48 years old) in Liaohe Sub-district, Shuangtaizi District

"During a rainstorm, the sidewalks on both sides of the Liaohe River would be seriously flooded, and the landscape paths are too low; it is particularly inconvenient to pass during rains, because the paths are full of water; there is also a smell from the sewers, the shoes are full of wastewater, and we can hardly drive fast on it."

Interview 8-5: Ms. Liu, etc. (35 years old) in Hongqi Sub-district, Shuangtaizi District

There are often small vendors occupying the road to sell cold drinks, snacks, and the like. In addition, we usually have to pass through the road when we going to work, which can cause road congestion when there are too many cars. Sometimes, oncoming cars refuse to give way to each other. We expect the management road along the river to be repaired, and road supporting facilities such as traffic lights, surveillance cameras and speed bumps be provided.

Due to the large pedestrian traffic, we usually cross the bridge by electric bike; however, this bridge is not safe now. We expected the damaged bridges along the Liaohe River be repaired and preferably some pedestrian bridges added to facilitate public traffic.

(2) Residents have an urgent need for rainwater and wastewater separation and water purification in ditches to improve ecological quality.

664. The existing rainwater and wastewater separation system in Panjin City is not perfect, and the municipal and pump stations in residential areas cannot achieve synchronous diversion; the phenomenon of false diversion is actually arising from the merging state at the end, which poses a risk of overflow pollution. In addition, the aging or even damage of equipment in most of the combined sewer pump stations in Panjin City has resulted in the inability to timely discharge wastewater from the sewer network, affecting the discharge capacity of the entire system. Moreover, almost all drainage pump stations are built together with rainwater and wastewater, and the two systems share a set of inlet facilities, resulting in a large amount of wastewater being discharged into the water body when discharging rainwater, causing pollution.

665. With the mixed discharge of wastewater and rainwater, not only surface water bodies are polluted, but pollutants may also infiltrate into groundwater systems, affecting groundwater quality. The problems arising from the imperfect rainwater and wastewater confluence system in Panjin City directly affect the production and lives of residents, including waterlogging, health risks, and infrastructure damage. In addition, the merging system has also caused significant damage to the ecological environment, especially in terms of water pollution, ecosystem imbalance, and groundwater and soil pollution, with potential long-term impacts that cannot be ignored. Therefore, improving the rainwater and wastewater separation system is not only to ensure the living quality of residents, but also related to the ecological environment health and sustainable development of the entire city.

Interview 8-6: Mr. Zhang, etc. (43 years old) in Shengli Sub-district, Shuangtaizi District

“Sometimes in the flood season, it is severely scoured by rainstorms. Usually, domestic wastewater flows into the Qingshui River. In summer, the smell is too stinky. Now we don’t go there for a walk.”

Underground drainage ditches are often blocked and damaged, and wastewater often comes out of manhole covers, which has been a problem for many years

(3) Surrounding shops and enterprises have an urgent need to reduce flood prone areas.

666. The long-term disrepair of the sewer network in Panjin City has an impact on the normal operation of shops and enterprises along the way. Urban waterlogging can easily cause property losses to shops and enterprises, especially damage to goods, equipment, and store facilities. For example, Wanda Plaza and privately operated fish ponds near Youyi Street will be affected during the flood seasons and rainy weather, which will affect the operation of shops and fish pond enterprises.

667. First, reduce impacts of waterlogging on business operations. Floods and road waterlogging can have a serious impact on the daily production and operation activities of merchants, factories, etc., often leading to traffic interruptions and damage to power facilities, affecting normal production and operation activities. The editorial team learned that merchants and enterprises hope that the government and agencies concerned can improve the drainage system, dredge the sewer network, and ensure that there is no large-scale water accumulation after the flood season and rain, reducing the impact on commercial activities and logistics. In addition, it is necessary to ensure that production equipment and factory facilities are not affected by floods and ensure the normal production and operation of enterprises. Rainwater and wastewater separation, as well as the construction of new pipelines, can improve drainage efficiency, reduce power and water outages arising from waterlogging in street shops, ensure the continuous operation of enterprises and shops, and reduce business interruptions arising from disasters.

668.Second, ensure the smooth flow of logistics and supply. The road waterlogging and traffic interruption arising from floods can seriously affect logistics transport, especially in low-lying areas and transport arteries of cities. Floods may delay the transport of materials and raw materials, thereby affecting production progress. The editorial team learned that surrounding enterprises hope that the city has complete drainage facilities, especially the drainage system around industrial parks and logistics hubs should be more efficient, in order to reduce impacts of road waterlogging on the supply chain, ensure the smooth transport of materials, and reduce the risk of supply interruption arising from floods.

669.Finally, improve customer experience and traffic. The problem of water accumulation not only affects the convenience of customers entering and leaving the shop, but also reduces the attractiveness of the commercial district. By improving drainage facilities, the commercial environment is optimized, and the consumer experience is enhanced, thereby attracting more foot traffic and increasing sales opportunities for businesses and shops.

670.By improving drainage facilities and reducing flood prone areas, impacts of rainy season waterlogging on shops and business operations can be effectively avoided, ensuring the safety and sustainable operation of businesses and shops, and bringing long-term economic benefits and customer growth.

(4) Students and their parents from schools along lines hope to plan the project implementation reasonably to avoid road traffic obstruction during construction

671.The sewer network in Panjin City is blocked, resulting in poor drainage. The original rainwater pump station is far from meeting the drainage requirements of its service area, and the facilities are severely aging over time. The diameter of the rainwater pipe network upstream of the underground ditch is small and requires systematic upgrading and reconstruction. Currently, there are water accumulation points and damaged street lights in some parts of the roads. There are a large number of schools distributed in Panjin City, and students, especially those facing further education and their parents, need to take detours to get off and go to school on some roads, spending a lot of time and energy. During project construction, road closures and restrictions are required, and vehicles must detour through peripheral roads and other long distances. This not only increases the traffic pressure on other road sections during peak school hours, but also disperses the energy of students and their parents, invisibly increasing their burden.

Interview 8-7: Ms. Zhang (35 years old) in Minzhu Road Sub-district, Xinglongtai District

My child will take the college entrance examination next year, and it will be inconvenient for me to take him to and from school during construction next year. Construction should be stopped during the exam to facilitate my traffic.

Sometimes when we take children to and from school after self-study at night, the roadside lights are not on. When there are few people passing by, even adults are afraid and worried about safety, but we have to take children to and from school every day.

(5) Low-income residents expect to participate in the Project.

672.During on-site interviews, it was found that low-income residents in the project area generally expressed support for the Project, with a support rate of up to 98.6%. If there are long-term job opportunities, they are willing to participate in the Project, implementation, and operation, such as working as construction site workers during construction; during project operation, participate in the cleaning of ecological shorelines, rainwater pump stations, and river patrol management to obtain on-site job opportunities, increase family income, and also take care of household chores.

673.Some low-income families have expressed their willingness to participate in the construction

and implementation of projects. For them, the Project is a good opportunity to increase their income. Because they can directly participate in the Project through labor and labor input, and participate in unskilled jobs provided by project construction to increase job opportunities and wage income, ultimately achieving the goal of having a stable source of income.

(6) Women have strong willingness to support the Project.

674. The comprehensive reconstruction project of municipal green ecology and digital infrastructure in Panjin City will improve the urban waterlogging situation, build new bridges, add lighting systems, monitoring systems, and road markings. For women, after the project is completed, it will save them a lot of time spent on transport to work, picking up and dropping off their children from school, and purchasing materials, promoting the safety of road travel; the construction of wetland parks will also provide a place for women to relax, take walks, and dance. When women learned about the construction scope of the Project, they urgently expressed the hope that Wetland Construction and Ecological Restoration, as well as drainage facility improvement and reconstruction would be conducted as soon as possible to reduce flood safety risks, bring them safer and more convenient transport in rainy weather, promote traffic safety in rainy weather, and enhance their sense of happiness in life.

675. Through a survey of 237 women at 41 project sites, it found that 96.2% of the female respondents are willing to participate in the Project. Therefore, local women have very high willingness to participate in the implementation of project construction. The willingness of Local women to participate in the Project is shown in the table below.

Table 8-2 Analysis of the Willingness of Local women to Participate in the Construction of the Project

Option	Indicator	Frequency	Percentage	Valid percentage	Cumulative percentage
Effective	Willing	228	96.2	96.2	96.5
	Unwilling	9	3.8	3.8	100
	Total	237	100	100	/

(7) Grassroots local residents expect to increase their awareness of the Project

676. After the preliminary participation and household survey and publicity of the Panjin PMO, PIU, relevant government departments in the project areas, ESIA unit and other agencies, 77.78% of the respondents in the project area have "heard of" the Project, indicating that local residents have increased their awareness of the Project. As for the respondents who have heard of the Project, the main way of hearing about it is through community / village committees, accounting for 66.67%; followed by government publicity, accounting for 54.63%, and relevant announcements, accounting for 36.11%.

677. During the fieldwork, interviews and FGDs, the ESIA unit found that the staff of government functional departments or grassroots government departments related to the Project had a certain degree of awareness of the construction scope of the Project. Most local residents learned about the project construction scope through various channels. However, the primary way for ordinary local residents to know about the Project is to listen to others, and the awareness and participation rate of grassroots people still need to be improved. This requires further increasing project promotion and actively guiding public participation.

Table 10-3 Demand Analysis of Primary Stakeholders of the Project

Component	Affected sub-district / township	Primary stakeholder	Demand analysis
Wetland Construction and Ecological Restoration Drainage Facility	Xinglongtai District: Youyi and Xingsheng Sub-districts Dawa District: Tianjia and Dawa	Local residents	Flood prone areas in the urban area affect residents' daily traffic, and there is an urgent need for comprehensive infrastructure reconstruction. a. Reconstruct the sewer network to ensure smooth water flow, eliminate flood prone areas, facilitate residents' daily traffic, and meet safety needs;

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Component	Affected sub-district / township	Primary stakeholder	Demand analysis
Improvement and Reconstruction	Sub-districts Shuangtaizi District: Liaohe and Tiedong Sub-districts		<p>b. Improve the river guardrail infrastructure to ensure the traffic safety of residents;</p> <p>c. Separate rainwater and wastewater to avoid water pollution;</p> <p>d. Improve the community emergency management system and establish a GRM for residents regarding pump stations or communities along roads.</p>
		<p>Affected workers of Xinglong Mark (9 households with 20 people, 12 males and 8 females)</p>	<p>The occupation of land by state-owned farms affects the employment and income of farm workers, and there is an urgent need for the implementation of compensation mechanisms</p> <p>a. Employment stability: Farm workers are generally concerned about whether they can continue to work in their current jobs after the project land is occupied, and whether there will be job losses due to land reduction.</p> <p>b. Income security, employees are concerned about whether they can receive fair and reasonable compensation, including land transfer compensation, job transfer subsidies, or employment training allowances.</p> <p>c. Re employment opportunities, if existing positions are affected, employees hope to have the opportunity to enter new employment positions through skills training or job transfer arrangements.</p> <p>d. The infrastructure is complete, and employees hope that the new facilities can improve the local transportation, water and electricity, communication and other basic conditions, while not affecting the convenience of daily life.</p>
		<p>Local shops and enterprises affected by Gaojia Pump Station Reconstruction, and Rainwater and Wastewater Separation (8 males and 11 females)</p>	<p>The affected shops and enterprises have an urgent demand for economic compensation and reduction of flood prone areas. Fair and reasonable compensation, shops and businesses hope to receive economic compensation that matches market value, including rental or property compensation, as well as relocation cost compensation.</p> <p>In case of monetary compensation, competent authorities will conduct a detailed survey on the AHs to learn their basic situation, evaluate their livelihood restoration needs, and provide employment skills training, startup skills training, agricultural skills training, etc. In addition, competent authorities and sub-district offices / village committees in Shuangtaizi District will make social or public welfare jobs to AHs having difficulties in livelihood transformation, and provide rental information for AHs that want to continue with commercial activities. In case of property swap, competent authorities will provide replacement housing to AHs where possible based on their expectations and third-party appraisal results, but this is currently infeasible as there is no suitable station or land available for replacement near the village collective.</p> <p>According to the fieldwork, all nonresidential buildings demolished for the Project are close to the high-speed railway station in Shuangtaizi District. It was originally planned to build a new market nearby, but it is impossible due to tight land supply. It is learned from FGDs that the AHs do not operate well in the junk market, and most stores are closed or semi-closed due to high overall operating costs. Therefore, all AHs have chosen monetary compensation.</p>
		<p>Local low-income residents and other vulnerable groups</p>	<p>Local low-income residents and other vulnerable groups expect to obtain job opportunities and jobs.</p> <p>a. Construct the sewer network and new pump stations to ensure convenient and safe daily traffic for old people, pregnant women, and children;</p> <p>b. During project construction, prepare a detour plan and maintain</p>

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Component	Affected sub-district / township	Primary stakeholder	Demand analysis
			smooth traffic flow; after the completion of the Project, provide appropriate vocational skills training and job opportunities; c. If there are stable job opportunities, low-income residents will have higher enthusiasm and willingness to participate in the Project.
		Local women	Enhance women’s community participation and voice, and protect women’s rights and interests. a. Construct a new sewer network and pump stations to ensure convenient and safe daily traffic for women in rainy weather; b. Enhance the voice of community women in the participatory management of pipeline excavation and pump station construction; c. During project construction and operation, make job opportunities first available to women.
		Nearby residents	Local residents expect to improve municipal infrastructure and ensure life and property safety. a. Connect water systems, expand pipelines and lay new pipelines to ensure safe flood discharge; b. Reinforce the river guardrails, and add antiskid steel plates to enhance residents’ sense of safety during travel; c. Separate rainwater and wastewater to avoid overflow pollution, improve the water environment, and ensure public health.

9 Public Consultation and Information Disclosure

9.1 Purpose

678. Public participation in ESIA is aimed at improving the quality of the ESIA, providing more information and suggestions, making the ESIA of construction projects more democratic and public, allowing the public directly or indirectly related to the project to participate in the ESIA, and ensuring the transparency and credibility of evaluation decisions; and provide their own opinions and perspectives to achieve the goal of making the evaluation more comprehensive and fair.

679. Public participation is an important component of the ESIA and an effective way to improve scientific decision-making. Public participation in construction projects is an important means of enhancing two-way communication and interaction between project construction units, environmental and social evaluation units, and the public. Through extensive public participation, the public directly or indirectly affected by project construction can fully understand the possible environmental and social impacts, take measures to mitigate the impacts, and the economic and social benefits brought by project construction. In addition, various opinions and suggestions can be provided, actively contributing to project construction, and jointly finding solutions to problems, minimizing the impact of project construction on the environment and society, avoiding environmental and social impact disputes during project construction and operation, and better coordinating development and environmental protection. Its main objectives are:

1) Analyzing public opinions comprehensively, and incorporating them into the E&S mitigation measures;

2) Realizing two-way communication between the public and construction agency to promote mutual understanding;

3) Learning public attitudes and opinions to eliminate public concerns and minimize adverse impacts on public interests;

4) Involving the public in post-ESIA evaluation and supervision as an integral part of the E&S management mechanism, thereby improving the Project's E&S benefits and realizing sustainable development.

9.2 Applicable laws, regulations and policies, and stakeholder identification

680.1) ESMFP and Stakeholder Engagement Plan of the Project, and domestic policies on public participation (see Chapter 2 for details);

681.2) Stakeholder identification and demand analysis (see Chapter 8).

9.3 Completed public consultation and information disclosure activities

682. In the Project, public participation and information disclosure is conducted by means of the Internet, newspaper, poster, bulletin board, questionnaire survey, FGD, in-depth interview and key informant interview.

683. According to the Environmental Impact Assessment Law of the PRC, Interim Measures for Public Participation in Environmental Impact Assessment, AIB's ESF (November 2022 amendment) and ESMPF disclosed in November 2021, the Panjin PMO and agencies concerned have conducted a series of information disclosure and public consultation activities.

684. During July 9-17, 2024, the ESIA unit conducted a public survey in the affected counties / districts with the assistance of Panjin PMO, PMCC, Panjin Emergency Bureau, SDHURDB, XDHURDB, DDHURDB, Panjin House Expropriation Affairs Center, relevant sub-district offices, property owners, communities/village groups, and individuals, conducted public survey work in the three project districts.

Table 9-1 Summary of Public Participation Activities

Type	Date	Venue	Scope	Participants	Needs	Remarks
Notification and disclosure of project related information	September 2022	Related websites http://fgw.panjin.gov.cn/2022_09/21_15/content-387301.html	Latest updates on the Project	District PMOs, local residents	/	1 st round of disclosure
	October 2022	Related affected villages	Information disclosure	District PMOs, FSR unit, relevant townships, communities / villages, and villagers	Reduce LA impacts and compensate for ground attachments.	
	October 2022	Affected Xinglong Community, Weijia Village, Gaojia Village and Yonghe Community	Disclosure project information during field visits to collect their expectations, attitudes and opinions on the Project	PMO, owners, technical consultants, district governments, village committees, villagers	Reduce LA impacts and compensate for ground attachments.	
	June 2023	Affected Xinglong Community, Weijia Village, Gaojia Village, Yonghe Community	Posting of announcement	Owners, ESIA unit, relevant community committees, residents	/	2 nd round of disclosure
	July and September 2023	Mainstream newspapers and magazines within the province, Liaoning Daily	Online publicity and posting of announcement	Owners and ESIA unit	/	
Fieldwork	July 9-17, 2024	Related affected villages	Socioeconomic sampling survey	Affected villages and sub-districts, PMOs, owners, and RAP preparation agency	Accelerate the implementation of flood control and drainage reconstruction to reduce impacts of floods on the economic and social development of the project area	One round
	July 9-17, 2024	Related affected villages	Learning opinions and suggestions of local residents regarding the implementation of the Project by means of field visit, questionnaire survey, interviews, etc.	Affected villages and sub-districts, PMOs, owners, ESIA unit	Reduce impacts of construction on transport, issue construction notices in advance, and set up traffic diversion plans;	
	July 9-17, 2024	Proposed project sites	Conducting field visits to the proposed project sites, communicating with community residents on project preparation, and collecting suggestions for project optimization	ESIA unit	Develop a construction detour plan, and conduct construction on half of the road width to minimize the impact on the original road and public traffic.	
Questionnaire survey	July 2024	Related communities / villages and residents' homes in the project area	500 copies of the questionnaire were distributed, with 500 valid copies recovered, with an effective response rate of 100%, in which males accounted for 52.6% and females accounted for 47.4%.	Village residents in the project area, ESIA unit	a. Avoid construction during the flood season to reduce floods; b. Avoid overnight construction that affects residents' rest; c. Establish a scientific and reasonable traffic diversion plan to reduce the impact on pedestrian traffic in schools, hospitals, residential areas, and concentrated commercial areas	One round

Chapter 9 Public Consultation and Information Disclosure

FGD	July 2024	Related communities / villages in the project area	18 resident FGDs were held, with a total of 312 participants. Among them, 91 were women, accounting for 29.17%; 56 old people, accounting for 17.95%; 153 heads of agencies concerned, community committees, and villager representatives, accounting for 50.4%.	APs, community / village committees, and villager representatives in the project area, ESIA unit	a. Avoid construction during the flood season to reduce floods; b. Avoid overnight construction that affects residents' rest; c. Establish a scientific and reasonable traffic diversion plan to reduce the impact on pedestrian traffic in schools, hospitals, residential areas, and concentrated commercial areas	One round
	November 2024	FGD with state-owned farm workers	20 farm workers, including 12 males (60%) and 8 females (40%)	State-owned Farm workers, ESIA unit	a. Employment stability: Farm workers are generally concerned about whether they can continue to work in their current jobs after the project land is occupied, and whether there will be job losses due to land reduction. b. Income security, employees are concerned about whether they can receive fair and reasonable compensation, including land transfer compensation, job transfer subsidies, or employment training allowances. c. Re employment opportunities, if existing positions are affected, employees hope to have the opportunity to enter new employment positions through skills training or job transfer arrangements.	Two rounds
Key informant Interviews	July 2024	Related institutions, communities / villages	57 key informant interviews were conducted with the heads of agencies concerned in the 3 districts, including 19 in Xinglongtai District; 20 people in Shuangtaizi District; 18 people in Dawa District.	Heads of government agencies concerned, community / village committees and villager representatives, employees of enterprises and public institutions, ESIA unit	Implement the Project as soon as possible to reduce the socioeconomic impact of floods. In addition, construction plans should be prepared, including notices and announcements before construction, and detour plans during road excavation to reduce impacts of construction on residents' production and lives at each stage.	/

9.3.1 Public participation outcomes at the preparation stage

685.1) Since April 2024, when the feasibility study was conducting fieldwork, the PMO began to communicate with local residents about the scope of construction, necessity and social benefits of the Project in the project area, and collected their attitudes and comments.

686.2) Since April 2024, under the direction of the technical assistance consultants, the Panjin Municipal Government, municipal finance bureau, county / district governments and design agency have conducted a public willingness survey and public consultation (with about 30% of participants being women) by means of village congress, questionnaire survey, brochure, WeChat public account, etc.

687.3) In July 2024, the ESIA unit visited the affected counties / districts, and learned local production and living conditions, economic and social conditions, traffic conditions, expectations for the Project, and potential impacts of the Project in detail, and notified local residents of the scope of construction, social benefits and impacts of the Project, compensation policies, restoration measures, etc. by means of questionnaire survey, FGD, organizational interview, in-depth interview, etc. Consultation results have been incorporated into the completed RAP.

688. From September 2022 to date, the Panjin Municipal Government, municipal finance bureau, and 5 affected county / district governments have disclosed updates of the Project on their websites.

9.3.2 Organizational interviews

689. The ESIA unit conducted 48 organizational interviews and FGDs with the Panjin PMO, PMCC, SDHURDB, XDHURDB, DDHURDB and other agencies involved in the project area (i.e., PIUs), county-level/district-level House Expropriation Affairs Center, Natural Resources and Planning Bureau, Ecology and environment bureau, Statistics Bureau, Human Resources and Social Security Bureau, Rural Revitalization Bureau, Ethnic Affairs Commission, Women's Federation, Civil Affairs Bureau, Environmental Protection Bureau, Transport management bureau and other institutions and departments, and collected basic data and literatures closely related to the Project. See the table below.

Table 9-2 Summary of Organizational Interviews

District	Organizational interviews	Agencies interviewed
Xinglongtai District	17	Panjin PMO, PMCC, XDHURDB, county-level/district-level House Expropriation Affairs Center, HD Office under the natural resources and planning bureau, ecology and environment bureau, statistics bureau, human resources and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport management bureau, and offices of Xinglong, Xingsheng and Zhenxing Sub-districts
Shuangtaizi District	16	Panjin PMO, PMCC, SDHURDB, county-level/district-level Housing Expropriation Affairs Center, HD Office under the natural resources and planning bureau, ecology and environment bureau, statistics bureau, human resources and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport management bureau, and offices of Jianshe, Shengli and Liaohe Sub-districts
Dawa District	15	Panjin PMO, PMCC, DDHURDB and other agencies, county-level/district-level House Expropriation Affairs Center, HD Office under the natural resources and planning bureau, ecology and environment bureau, statistics bureau, human resources and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport management bureau, and offices of LiTianjia and Dawa Sub-districts
Total	48	-----

9.3.3 Field visits

690. The ESIA unit paid field visits to the townships / sub-districts, communities / villages, the conditions of rivers, roads, and infrastructure along the Yitong River, Liaohe River, Pangxie Ditch, Qingshui River, Zhaoquan River, the urban area affected by the construction of the 41

subcomponents in the 3 project districts, as well as the construction sites in order to learn the Project's potential impacts on local residents, local residents' production and living conditions, and their suggestions, concerns and expectations. See the figure and table below.



New City Yayuan resettlement housing in Shuangtaizi District



Field visit to Gujia Pump Station



Field visit to Youyi Sub-district Wetland Park



Field visit to Longhua Temple



Field visit to Zhuanglin Pump Station



Field visit to Taishan Pump Station



Field visit to Yangjia Canal



Field visit to a project sites

Figure 9-1 Fieldwork Photos

Table 9-3 Summary of Field Visits

City	District	Sub-districts	Communities visited
Panjin	Xinglongtai	Xingsheng, Xinglong	Xingwang, Jinhe
	Shuangtaizi	Tiedong, Hongqi, Liaohe, Jianshe, Shuangsheng, Shengli	Hezha, Zhanbei, Shuanghe, Liaohe, Zhanqian, Nanqian, Guangming, Liaohe River Left Bank, Jingqi, Tuanjie, Binhu
	Dawa	Tianjia, Dawa	Maquanquan, Dongfang, Kunlun, Tianjia, Sixin, Dongsheng, Dongshan

9.3.4 FGD

691.To further learn needs and suggestions of the APs (including local urban and rural residents, women, low-income residents, vulnerable groups), comments and concerns, the ESIA unit held FGDs during the fieldwork. The ESIA unit held 18 FGDs with 312 persons, including 91 females, accounting for 29.17%; 56 old people, accounting for 17.95%; and 153 village officials and villager representatives, accounting for 50.4%. See the figure and table below.





Figure 9-2 FGDs (Part)

Table 9-4 Summary of FGDs and Participants

District	Composition and sessions of the symposium						Total	
	Women		Old people		Heads of agencies concerned, community committees, and resident representatives		Participants	Number of FGDs
	Participants	FGDs	Participants	FGDs	Participants	FGDs	Participants	FGDs
Xinglongtai	21	3	25	3	63	3	109	9
Shuangtaizi	37	2	13	2	42	2	92	4
Dawa	25	2	18	2	48	2	91	4
Total	83	7	56	7	153	7	292	17

9.3.5 Key informant interviews

692. The ESIA unit interviewed 57 key informants at the county / district, sub-district and village / community levels to further collect attitudes and suggestions from stakeholders.



Figure 9-3 Key Informant Interviews (Part)

693. A total of 57 key informants were interviewed in this survey, including 19 in Xinglongtai District; 20 people in Shuangtaizi District; 18 people in Dawa District. See Table 9-5.

Table 9-5 Summary of Key Informant Interviews

District	Heads of agencies	Village / community officials	Total
Xinglongtai District	11	8	19
Shuangtaizi District	10	10	20
Dawa District	9	9	18
total	30	27	57

9.3.6 Questionnaire survey

(1) SIA survey

694. The sample size was 500 based on a confidence level of 95% and a maximum absolute error of 5% using the probability proportional to size (PPS) method. 500 copies of the questionnaire were completed.



695. The specific distribution of the sample for the SIA questionnaire survey in the project area is shown in Table 9-6.

Table 9-6 Sample Distribution of the Questionnaire Survey

District	Number of respondents (copies)	Percentage (%)
Xinglongtai District	159	10.08%
Shuangtaizi District	176	12.43%
Dawa District	165	10.89%
total	500	100%

696. The questionnaire database was established and analyzed using the IBM SPSS software. See Table 9-7.

Table 9-7 Basic Information of the Valid Sample

Indicators	Statistical value
Gender	Male (263): 52.6%; female (237): 47.4%.
Age	18-24 years: 12.96%; 25-34 years: 27.78%; 35-44 years: 25.93%; 45-54 years: 22.22%; 55-64 years: 9.26%; 65 years or above: 1.85%
Urban / rural	Urban: 96.8%; areas: 3.2%.
Education level	Illiterate: 1%; primary school: 7%; junior high school: 54.5%; senior high school / secondary

	technical school: 22.25%; junior college or above: 15.25%
Occupation	Civil servant: 6.75%; worker of public institution: 16.0%; enterprise worker: 14.75%; self-employer: 16.5%; freelancer: 19.0%; unemployed: 0%; student: 6.25%; retiree: 7.25%; farmer: 5.25%; low-income residents: 6.4%; other: 7.5%
LAR	A sample survey was conducted on 120 people from 56 households affected by LAR. Among them, 11 households with 40 people are affected by LA (including 2 households with 5 people affected by temporary occupation of collective land and 9 households with 35 people permanently occupation of state-owned farm land), accounting for 100% of all households affected by LA only; 22 households with 51 people affected by HD, accounting for 100% of all households affected by HD only; 23 households with 29 people affected by both LA and HD, accounting for 46% of all households affected by both LA and HD.

9.4 Public Participation Plan

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

698.Based on stakeholder identification and the project content, a public participation plan for each stage of the Project has been developed, as detailed in the table below.

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Table 9-8 Stakeholder engagement plan for all stages

Stage	Activity	Mode	Implemented by	Participants	Topic	Progress	Funding source
Preparation	Project information disclosure	TV, broadcast, poster, leaflet, village meeting, village committee, internet	PMO, township governments, village committee	Residents, township officials, PMO	Disclose the Chinese and English versions of the ESIA report and ESMP online in AIIB website and Panjin Housing and Urban Rural Development Bureau website; The PMO publicly discloses basic project information; The PMO, township, and village committee collect residents' opinions and suggestions; The PMO answers residents' questions.	Ongoing	Project budget
	Design participation and consultation	Interview, FGD, disclosure	PMO, design agency, consulting agency	Residents, PMO, design agency, consulting agency, village committees, communities	The design agency and consulting agency encourage residents to provide their opinions and suggestions on the relevant design content during the scheme design process; After the preliminary design of the plan is completed, the PMO should publicize the plan in the project village and collect residents' opinions and suggestions.	Completed	Project budget
	ESIA information disclosure and consultation	Online, newspaper, poster, leaflet, village meeting, notice, FGD, questionnaire survey	PMO, owners	Sub-district offices / township governments, village / community committees, residents, schools, shops	The owners publicly discloses the construction plan, construction time and schedule; Distribution of construction sites; Main E&S impacts of construction and proposed mitigation measures; Main conclusions of ESIA;	Completed	Project budget

Table 9-9 Stakeholder engagement plan for the construction and operation stages

Stage	Activity	Mode	Implemented by	Participants	Topic	Funding source
Construction	Construction information disclosure	Village congress, bulletin board, poster, broadcast	PMO, construction agency, village committees	Residents, PMO, construction agency, village committees	Publicly disclose the construction plan and schedule; Disclose the distribution of construction sites. Disclose key impacts of construction; Disclose environmental issues of concern to villagers. Disclose the construction agency's liaison officer and contact information, etc.	Internal budget of construction agency
	GRM disclosure	Media, poster, leaflet, FGD, questionnaire survey	PMO, owners, contractors	sub-district offices / township governments, village / community	The owners and construction agency disclose the project implementation supervision hotline at appropriate locations and open channels for handling appeals; The owners handle the complaints raised by residents during the	Project budget

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Stage	Activity	Mode	Implemented by	Participants	Topic	Funding source
				committees, residents, schools	operation of the project through various channels such as on-site appeals, letters, and phone calls, and provide on-site notification. If on-site notification is not possible, a reply will be given within 15 days; The construction agency pays attention to listening to the opinions of vulnerable groups such as women and low-income groups, ensuring the openness, fairness, and transparency of project implementation.	
	Information disclosure before construction	Online and on-site disclosure	PMO	sub-district offices / township governments, village / community committees, residents, schools	Publish the environmental and social impact assessment report and management plan of this project in both Chinese and English versions on the PMO website and the AIIB website before construction. In addition, the PMO prepares paper versions of the environmental and social impact assessment report and management plan for public review.	Project budget
	Project information disclosure	On-site announcement	Contractors	sub-district offices / township governments, village / community committees, residents, schools	The construction agency sets up bulletin boards at the entrance of the construction site, indicating the project contractor, construction supervision unit, construction period, and strives for the understanding and empathy of the affected people for the temporary interference caused by the project construction. The construction agency participates in the public participation meeting held by the owners in the affected community. At the meeting, the construction agency assigns a dedicated person to explain the construction activities and the environmental protection measures that have been or will be taken.	Project budget
	Reducing construction impacts	Design optimization	PMO, construction agency, village committees	PMO and Construction agency transport bureau, traffic police, ecology and environment bureau, community / village committees, resident / villager representatives	The construction agency leaves a passage for local residents during road excavation. The construction agency takes dust and noise reduction measures. The construction agency evades living areas and daily passages during the construction of pipelines. The construction agency identifies the households affected by temporary land occupation.	Project budget
	Participation in construction	Village meeting, village congress	PMO, construction agency, village committees	Residents, PMO, construction agency, village committees	The construction agency determines the jobs to be generated by the Project. The construction agency determines the selection criteria for construction workers, and making jobs first available to poor residents and women.	Internal budget of construction agency

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Stage	Activity	Mode	Implemented by	Participants	Topic	Funding source
					<p>The construction agency determines salaries, and skills and safety training for workers.</p> <p>The village committee leverages existing community and village committees to encourage residents to participate in public affairs, project discussions, and suggestion forums, and establishes corresponding incentive mechanisms;</p> <p>The village committee provides environmental awareness and garbage classification training to residents to enhance their participation awareness.</p> <p>Before collecting personal images and information, transparently disclose the location, functions, and data collection purposes of the devices to residents, so that they have the right to know.</p>	
	Management of nonlocal workers	Health and safety publicity, and worker education	PMO Construction agency health bureau Village committees Local residents	PMO, contractors, health bureau, health centers, village committees, nonlocal workers, local residents	<p>The construction agency strengthens the regulation of construction sites to avoid SEA / SH and GBV, and establishes a clear GRM.</p> <p>The construction agency establishes a grievance redress team at each construction site, which has at least two female members, and ensures the safety of its members.</p>	Project budget
	GRM disclosure	Media, poster, leaflet, FGD, questionnaire survey	PMO, owners, contractors	sub-district offices / township governments, village / community committees, residents, schools, shops	<p>The construction agency discloses the hotline numbers and contact names of local environmental, social, and urban management authorities at the construction site, to facilitate the affected public to contact relevant departments when they discover that the construction agency has violated regulations.</p> <p>The owners and construction agency handle complaints raised by residents during the operation of the project through various channels such as on-site appeals, letters, and phone calls, and provide on-site notification. If on-site notification is not possible, a reply will be given within 15 days;</p> <p>The construction agency pays attention to listening to the opinions of vulnerable groups such as women and low-income groups, ensuring the openness, fairness, and transparency of project implementation.</p>	/
Operation	Flood control and water safety education	Workshop	PMO, village / community committees	Residents, village committees	<p>The village committees strengthen flood safety education to improve residents' safety awareness.</p> <p>The village committees organize a workshop on flood control and safety, and conduct early warning and drilling to improve residents'</p>	Special budget of competent authority,

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Stage	Activity	Mode	Implemented by	Participants	Topic	Funding source
					<p>flood safety awareness. Diversified disaster training is offered (earthquake, flood control, etc.). The village committees increase the proportions of women, old people and children in flood control education and training. The PMO and village committees strengthen the training of natural disaster officers.</p>	<p>collective finance</p>
	Environmental protection and energy conservation	Workshop	PMO, village committees	Residents, village committees, municipal ecology and environment bureau	<p>The village committee and relevant departments hold environmental knowledge lectures to encourage residents to take action in their daily lives:</p> <p>a. Introduction to Garbage Classification: Educate residents on how to properly classify and dispose of garbage to reduce its impact on the environment.</p> <p>b. Bicycles and public traffic: Encourage the use of bicycles and public traffic, reduce dependence on personal cars, and lower carbon emissions.</p> <p>c. Environmental Policy Understanding: Introduce local environmental policies and initiatives to encourage residents to participate in community environmental projects.</p> <p>d. Green Community Initiative: Encourage residents to participate in community green initiatives such as cleaning actions, tree planting, etc.</p>	<p>Special budget of competent authority, collective finance</p>
	GRM disclosure	TV, broadcast, poster, leaflet, village committee, village committee notice, internet	PMO, government agencies concerned, village committees	PMO, government agencies concerned, township governments, village committees	<p>The PMO discloses the project implementation supervision telephone number at an appropriate location and open a channel for handling appeals;</p> <p>The relevant government management departments and village committees handle the complaints raised by residents during the operation of the project through various channels such as on-site appeals, letters, and phone calls, and provide on-site notification. If on-site notification is not possible, a reply will be given within 15 days;</p> <p>The PMO, relevant government management departments, and village committees pay attention to listening to the opinions of vulnerable groups such as women and low-income groups, ensuring the openness, fairness, and transparency of project implementation.</p>	<p>/</p>

10 Grievance Redress Mechanism

10.1 GRM Channels

699. In the process of project preparation, construction, and operation, in order to timely understand and solve the impact and problems brought by the project to stakeholders, ensure the residents' demand for information disclosure and the widest possible community participation, combined with the current situation of residents' complaints and grievances in the project area, a project level complaint channel will be established. All appeal records and resulting resolutions will be kept through the semi annual environmental and social monitoring mechanism and reported to the AIIB. The following GRMs will be disclosed through village bulletin boards and construction sites.

700. The GRMs of the Project will be extended and expanded based on some existing appeal mechanisms in Panjin City, such as environmental protection hotlines and municipal mayor hotlines. There are two GRMs under the Project mainly:

701. The first is the project level GRM, which provides a channel for appeals to affected residents, social groups, and business entities during the implementation and operation of the project.

702. The second is the GRM for project workers, including direct workers, contract workers, and employees responsible for the project, providing a channel for appeals.

(1) GRM for APs

703. The appeal mechanism 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, residents of Panjin City mainly report problems through the mayor's complaint hotline 0427-12345 and the environmental protection hotline 0427-12369. The improved appeal mechanism of the Project complies with the regulatory standards of the People's Republic of China, which protect citizens' rights from environmental and social impacts related to construction. The "No. 431 Petition Regulations" issued by the State Council of the People's Republic of China in 2005 stipulate the complaint acceptance mechanism for governments at all levels and protect them from retaliation. According to this regulation, the former Ministry of Environmental Protection issued the latest "Measures for Environmental Letters and Visits" (Law No. 15) in December 2010.

704. The Panjin PMO was established in June 2023, and 4 staff members of the Overall Coordination Department are responsible for GRM operation. If the Panjin PMO receives a grievance, it will first check if such grievance relates to the Project. If yes, it will redress such grievance through coordination. If no, it will forward such grievance to the competent authority for the griever. All grievances will be recorded, and the whole grievance redress process notified to relevant staff. The basic procedure and timeframe of the GRM are as follows:

705. Stage 1 (5 days): If any problem occurs at the construction or operation stage, an AP may file a written or oral grievance to the contractor. The contractor will: 1) stop the relevant activity (e.g., construction with noise impact on nearby residents) immediately; 2) not restore such activity before the grievance is closed; 3) notify the IA of the grievance received and the proposed solution; 4) give a definite reply to the AP within two days; and 5) close the grievance within 5 days after receipt where possible.

706. Stage 2 (5 days): If the contractor cannot find a solution, or the AP is dissatisfied with the proposed solution, the IA will hold a meeting with the main stakeholders (including the contractor and AP) to develop a solution accepted by all, including key steps. The contractor should implement such solution immediately, and close the grievance within 15 days. All measures and results should be recorded.

707. Stage 3 (15 days): If the IA cannot find a solution, or the AP is dissatisfied with the proposed

solution, the Panjin PMO will hold a stakeholder consultation meeting within 7 days (including the griever, contractor, local ecology and environment bureau, human resources and social security bureau, urban administration bureau, etc.) to develop a solution accepted by all, including key steps. The contractor should implement such solution immediately, and close the grievance within 15 days. All measures and results should be recorded. At the end of Stage 3, the Panjin PMO will notify the outcome to AIIB.

708.Stage 4: If the griever is still dissatisfied with the disposition of Stage 3, he/she may apply for arbitration with the competent authority in accordance with the Administrative Procedure Law of the PRC.

709.Stage 5: If the griever is still dissatisfied with the arbitration award, he/she may file a suit in a civil court in accordance with the Civil Procedure Law.

710.(2) GRM for workers

711.The project will set up a complaint committee to deal with any complaints raised by construction workers, including workers directly or indirectly involved. The members of the appeal committee include: the environmental and social staffs of PMOs, supervision engineers, representatives of workers, contractors, and suppliers. The environmental and social staffs of the project IA will be responsible for handling complaints and ensuring that affected workers will not be dismissed due to complaints, nor will they withdraw their complaints due to intimidation before a formal hearing.

712.At the same time, in GBV management, relying on the guidance and coordination of PMOs, district women's federations, township/street, and village/community women's federations, specialized commissioners responsible for safeguarding women's rights and interests are set up in project implementation or operation institutions, project construction units (contractors), etc. In terms of protecting female employees from workplace sexual harassment, effective measures are taken in combination with the work and production characteristics of the unit to prevent and stop female employees from being sexually harassed in the workplace. And establish a rapid response mechanism for female workers and women in the project area to file complaints or suggestions regarding GBV. If there is sexual harassment or other behavior that endangers the personal safety of female employees in the workplace, the victim can immediately report or complain to the employer. The employer should handle it in a timely manner and protect the personal privacy of female employees in accordance with the law. The hotline of Panjin Women's Federation is 0427-3380020/12338.

713.In addition, the PPM was established by AIIB to provide an opportunity for an independent and impartial review of submissions from Project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement its Environmental and Social Policy (ESP) when their concerns cannot be addressed satisfactorily through Project-level grievance redress mechanisms or AIIB Management's processes. For more information, visit: <https://www.aiib.org/en/policies-strategies/operational-policies/policy-on-the-project-affected-mechanism.html>.

10.2 Recording and feedback of complaints and appeals

714.During the implementation of the ESMP, the relevant agencies should register and manage appeal and handling information, and submit such information to the Panjin PMO monthly, which will inspect the registration of appeal and handling information regularly.

715.To record grievances and their handlings, the Panjin PMO and PIUs have prepared a registration form, as shown in Table 10-1.

Table 10-1 Grievance Registration Form

Appellant	Time	Location	Feedback of accepting agency	PMO's advice	External M&E agency's advice	Progress	AIIB's opinion
Appeal							

Expected solution							
Proposed solution							
Actual handling							
Person responsible (signature)							
Notes: 1. The recorder should record the appeal and request of the appellant factually. 2. The appeal process should not be interfered with or hindered whatsoever. 3. The proposed solution should be notified to the appellant within the specified time.							

10.3 Contact information for expressing grievances and appeals

716. The project social action implementation agency will arrange a main person in charge to specifically receive and handle the dissatisfaction and complaints of the affected population. The name, office address, and contact phone number of the person in charge are shown in Table 10-2. After the bidding is completed, the construction unit and the supervision unit need to confirm the environmental and social responsible person as the contact person for their appeal mechanism.

Table 10-2 Contact Information for Grievance Redress

Agency	Contact	Address	Tel
PMHURDB	Xu Shifeng	No.107 Huibin Street, Xinglongtai District, Panjin, Liaoning	0427-2824706
PMCC	Li Xiaohui	No.73 Jincheng Road, Xinglongtai District, Panjin, Liaoning	0427-3873002
Panjin Municipal Civil Affairs Bureau	Liu Shanmin	No.311 Shiyou Street, Xinglongtai District, Panjin, Liaoning	18842730411
Panjin Municipal Human Resources and Social Security Bureau	Chen Pinzhao	No.106 Huibin Street, Xinglongtai District, Panjin, Liaoning	16566999595
Panjin Municipal Natural Resources Bureau	Dong Gang	No.109 Huibin Street, Xinglongtai District, Panjin, Liaoning	13898710408
Panjin Municipal Ethnic and Religious Affairs Bureau	Yu Xikui	40 meters east of the intersection of Huibin Street and Finance Road in Xinglongtai District, Panjin, Liaoning	13019963927
SDHURDB	Gao Donglei	Building E, Zhongzhu Building, Liangzhongchang, Shuangtaizi District, Panjin, Liaoning	13324271818
Xinglongtai District Urban Construction Center	Gao Jian	No.107 Huibin Street, Xinglongtai District, Panjin, Liaoning	18242752247
Urban and Rural Construction Management Office of DDHURDB	Cao Meng	20 meters northwest of the intersection of Xinhua Street and Zhongxin Road in Dawa District, Panjin, Liaoning	13324253399

11 Community and Occupational Safety and Health

11.1 Community Health and Safety

11.1.1 Potential risk analysis

717. According to Section 5.7, the exhaust gas, dust and noise generated during the construction and operation phases may affect the health of residents in the surrounding communities. Trucks transporting construction materials and equipment passing through the surrounding communities may also pose a threat to the travel safety of residents in the surrounding communities; after the project is put into operation, the increased traffic volume also increases the risk of traffic accidents on the roads in the surrounding communities.

718. It shall be noted that there will be more than 100 construction personnel for the project, and the personnel are relatively concentrated, and the construction area is likely to cause cross-infection of diseases. If food hygiene and environmental sanitation in residential areas are not taken seriously, bacteria, mosquitoes and flies will be easy to grow and reproduce in the season of increased rainfall and high humidity, and people may be infected with bacillary dysentery and malaria. At the same time, since the construction camps do not provide dormitories, the construction workers from other places rent houses in the surrounding communities, and the construction workers commute between the community and the project site. The mobility of personnel will be high, which will be easy to cause the outbreaks and prevalence of infectious diseases in the community, such as flu, intestinal infectious diseases, viral infections, hepatitis and tuberculosis.

11.1.2 Management measures

719. In order to reduce the risk of traffic accidents when transport vehicles pass through surrounding community roads, truck drivers should be trained with travel safety, stipulating driving speeds, and slowing down when passing residential areas; overloading transport vehicles are strictly prohibited, and regular maintenance shall be carried out for vehicles to reduce the risk of failures causing traffic accidents;

720. Necessary sanitation and epidemic prevention measures shall be taken for construction personnel, and regular physical examinations shall be carried out. However, according to the practical experience of the project in recent years, as long as various sanitary and epidemic prevention measures are implemented, the incidence of diseases among construction workers can be effectively controlled;

721. The sanitation of food and drinking water for construction workers shall be secured;

722. Temporary toilets set up on the construction site and toilets equipped during the operation phase should be regularly cleaned and disinfected;

723. The contractors and project management department in the construction area should specify the persons responsible for sanitation and epidemic prevention, carry out the publicity and education of employees' sanitation and disease prevention. Regarding seasonal epidemics, infectious diseases, etc., knowledge and methods of disease prevention and treatment should be introduced to construction personnel through broadcasting, promotional manuals, bulletin boards, and other forms;

724. Construction personnel must take health checks and quarantine before entering the site, and personnel with infectious diseases are not allowed to enter the construction team;

725. If a new infectious disease is found, the patient must be isolated and treated to cut off the transmission route to avoid spreading to the surrounding communities, and at the same time establish the health records of the construction personnel..

11.2 Occupational Health and Safety

11.2.1 Potential Risk Assessment

(i) Potential risk assessment of construction machinery and equipment:

726. Construction sites present considerable dangers, and thousands of people are injured on construction sites each year. The construction process of this project involves a large amount of engineering and complex construction operations. The heavy construction machinery used in the construction process of the project will pose a considerable risk to the personal safety of workers if the workers use them improperly or the management of the contractor is not in place. Misuse of heavy machinery such as excavators, motor graders, loaders, and skip loaders including accidental start-up, false touches, breakdowns, operating errors, and movement can result in injury or death to workers. In addition, during the process of transporting construction materials, engineering vehicles may have traffic accidents with workers on the construction site, resulting in injury or death of workers.

(ii) Potential risk assessment of occupational diseases

727. Exposed to noise, dust, exhaust gas and other factors that may affect health on the construction site, workers have a certain risk of occupational diseases.

728. Most of the dust formed on the construction site is falling dust, with a particle size of 10 μm to 100 μm , among which the particle size of cement dust is about 100 μm ²⁷, causing air pollution on the construction site. There are three ways for dust to enter the human body: respiratory inhalation, digestive tract ingestion, and skin contact. Inhalation of dust in the respiratory tract has the most serious harm to the human body. Workers exposed to the dust environment for a long time are prone to diseases that can cause upper respiratory tract inflammation, chronic bronchitis, bronchial asthma, coronary heart disease, arteriosclerosis, high blood pressure, and even cancer.

729. This project involves the construction of several road works, using asphalt for road paving. Asphalt contains a variety of organic volatiles, including acridine, phenols, benzene, pyridine, anthracene, naphthalene, etc., which are harmful to the human body²⁸. Organic volatiles will volatilize from asphalt into the air at a certain temperature, and cause acute poisoning of workers through skin or mucous membrane contact. The general symptoms include acute erythema, dermatitis and ophthalmia, or cause headache, nausea, and elevated body temperature.

730. In addition, construction machinery and transport vehicles on the construction site will generate continuous and frequent noise, which will cause noise pollution to the construction site and the surrounding environment. Exposure to high noise environments for long time without any effective protective measures can lead to irreversible hearing damage and even occupational deafness. In addition to causing physical injury, high noise can also threaten the mental health of workers. Exposure to loud environments can easily upset workers and cause distraction, which can lead to improper operation that can lead to work-related injuries or fatal accidents.

(iii) Potential risk assessment of electric shock

731. There are often complex circuits and a certain number of electrical equipment on the construction site, so electric shock is a common accident on the construction site. Exposed or faulty electrical equipment, such as circuit breaker panels, cables, cords, and hand tools, can pose a serious risk to workers.

(iv) Potential risk assessment of high temperature burns

732. The road construction of this project requires asphalt paving, which needs to be carried out at high temperature, the highest temperature can reach 175 °C, and the lowest temperature is 80 °C. If operated improperly or lacking protection, workers are in danger of being burned by high temperature.

(v) Potential risk analysis of poisoning

²⁷ Safety Management. (2012, June 5). Occupational Health Hazards for Construction Workers and Self-Prevention Measures.

²⁸ Occupational Health and Sanitation. (2023, June). What are the dangers of asphalt? Symptoms and treatment and prevention measures of asphalt poisoning.

733. In equipment or structures such as pipelines and collection wells, due to the presence of various pollutants in the sewage stored on a daily basis, toxic and harmful gases such as H₂S are produced through microbial action and other factors. Due to poor ventilation and long-term accumulation, the concentration is high, which may have a toxic effect on maintenance personnel. When the water pump, grille cleaning machine, deodorization equipment, induced draft fan malfunction or other management factors cause abnormal situations, as well as dredging operations, workers working underground through the electric hoist in the pump room will come into contact with toxic gases such as hydrogen sulfide, ammonia, and methyl mercaptan accumulated in the limited space. If the concentration of toxic gases is too high, personal protective measures are inadequate, and there is no on-site supervision or supervision, or if there is blind self rescue and mutual assistance after poisoning, chemical poisoning may occur, and even accidents involving the death of workers may occur.

11.2.2 Management Measures

734. To mitigate potential health and safety risks to workers during project construction and operation, the following measures will be taken:

- (i) Comply with relevant domestic regulations on occupational health and safety, such as *General Specifications for Safety, Hygiene and Occupational Health at Building and Municipal Construction Sites*;
- (ii) Follow the requirements of *Occupational Exposure Limits of Hazardous Factors in the Workplace*, *Catalogue of Occupational Diseases* and *Catalogue of Occupational Hazardous Factors*, and establish a regular monitoring system for occupational diseases and occupational hazards;
- (iii) Establish and improve the construction supervision and management system, and set up construction safety supervisors at the construction site;
- (iv) Develop an emergency response plan;
- (v) Strengthen workers' awareness of occupational health and safety, and post occupational health and safety promotional materials in conspicuous places on the construction site;
- (vi) Regularly organize occupational health and safety and emergency response training for workers;
- (vii) Provide PPE (Personal Protective Equipment) that meets Chinese national standards, including gloves, goggles, safety shoes, and provide earplugs for employees exposed to high noise environments;
- (viii) Supervise the proper use of personal protective equipment by workers;
- (ix) Workers should pay attention to the sealing and ventilation of equipment during operation and inspection in the workplace, and wear standard gas masks or respirators; Special personnel should be entrusted to carry out regular dredging operations, and comprehensive ventilation should be carried out before the operation. Oxygen masks should be worn during the operation. When working in a confined space, there should be a dedicated person outside to monitor and prevent acute hydrogen sulfide poisoning in the confined space. In addition, employers should strengthen occupational health management. Newly hired employees should be informed of potential occupational hazards and protective measures, and receive regular training to enhance their self-protection awareness and ensure their health and safety.
- (x) Before construction starts, use low-noise equipment and processes instead of high-noise equipment and processes when selecting construction machinery and equipment, such as low-noise vibrators, fans, electric air compressors, electric saws, etc., and install mufflers at the sound source muffled. After the construction machinery is used for a period of time, it may produce more noise, and the noise can be properly reduced through repair and maintenance;
- (xi) Take safe traffic control measures, set up eye-catching road signs and warnings on the construction site; limit the speed of transport vehicles, and regularly maintain vehicles and mechanical equipment to minimize the risk of accidents.

11.3 Traffic and road safety

735.The impact of road closure and traffic congestion, pipeline excavation, river slope, construction period need to close or semi-closed roads, increase traffic pressure easily lead to traffic congestion, traffic diversion and diversion also increase the possibility of traffic accidents.

736.The impact of construction vehicles on road safety. During the construction process, a large number of trucks, excavators and engineering vehicles frequently enter and exit the construction area. The large size and slow speed of these vehicles may lead to inconvenient traffic and even traffic accidents. These vehicles may temporarily occupy road space during loading and unloading, increasing the risk of the road.

737.Road damage and safety risks, large construction vehicles frequently run over the road during the project, which may lead to road damage and increased potholes; In the process of pipeline excavation or river slope protection construction, temporary roads or Bridges are often used for vehicles and pedestrians to pass through, and the quality and safety of these temporary facilities may not be as good as formal roads, leading to the risk of collapse, rollover and other accidents.

738.Specific actions or measures to address traffic safety impacts include:

a. Public disclosure of construction information and regular information progress update, the detailed information of the project will be publicized in advance to ensure the right of residents to know, so that residents can respond well in advance.

b. Reasonably plan the route of large vehicles and carry out off-peak travel.

c. Improve traffic signs, strengthen traffic safety publicity in the construction area, increase traffic detour schemes and set up temporary passageways.

d. Make detailed construction detour plans for roads requiring deep excavation and add obvious safety warning signs and obstacle reminders.

e. Timely repair the road surface damaged due to construction, avoid traffic congestion caused by construction, and strictly check and accept the road section after construction to ensure quality.

11.4 Labor rights protection

739.During the construction period of the project, the restoration and upgrading of municipal roads and water conservancy facilities in Panjin City involve a wide range, deep degree, and large amount of work, which will require the organization of professional construction teams for construction. Once the professional construction teams cannot meet the qualifications and construction requirements locally, a certain amount of labor will need to be imported from other places (provinces, cities, counties). Expected to import approximately 268 labor force from other regions (approximately 228 male workers and 40 female workers (14.93%)); We are recruiting approximately 580 local workers (490 male and 90 female (15.52%)), mainly including movers, scaffold workers, bricklayers, cleaners, chefs, etc. Among them, male labor mainly works as laborers and technical workers, while female labor mainly works as laborers and non-technical workers. During the construction process and daily affairs on the construction site, special attention should be paid to gender based violence, and discrimination against women should be avoided in the use of working hours to prevent physical, mental, or sexual harm to women, including threats, coercion, or arbitrary deprivation of freedom based on gender. During the construction process, special attention should be paid to the ratio of male and female laborers, and the proportion of female laborers should be increased.

740.A large number of migrant workers have settled in the project area for long-term operations, which to some extent increases the intensity of communication and interaction with local residents. At the same time, migrant workers will move and consume in residential communities and related street shops near the construction site, thereby causing certain social and health risks. For example, in terms of residents' health and hygiene, some epidemic diseases (including AIDS, COVID-19, influenza, etc.) have conditions to spread and spread; At the same time, if outsiders lack understanding of the local social, cultural, and traditional customs in the project area, they may unintentionally violate local social and cultural customs (including religious beliefs, tombs, temples, weddings, funerals, festivals, etc.), which may lead to potential crises and troubles. In order to mitigate the risks caused by the influx of labor, it is necessary to develop appropriate procedures for managing worker camps.

Table 11-1 List of Expected Personnel Composition and Job Types Engaged in Project Construction

Statistical indicators Project area	The proportion of migrant workers (people) - female workers should not be less than 10%	Mainly engaged in various occupations	Local recruitment (personnel) - The proportion of female laborers should not be less than 10%	Mainly engaged in various occupations	total
Xinglongtai District	110	Project management, financial management, contract management, large-scale machinery operation, etc.	220	Construction workers, material transportation, cooks, cleaners, etc.	330
Shuangtaizi District	86	Project management, financial management, contract management, large-scale machinery operation, etc.	184	Earthwork transportation, material transportation, construction workers, cooks, cleaners, etc.	270
Dawa District	72	Project management, financial management, contract management, large-scale machinery operation, etc.	176	Earthwork transportation, material transportation, construction workers, material transportation, cooks, cleaners, etc.	248
total	268	/	580	/	848

741. The PMO and PIU shall ensure that the construction unit and contractor strictly comply with the relevant laws and regulations of the People's Republic of China on labor safety, and ensure that project implementation personnel are treated fairly in accordance with the labor management measures and regulations of Panjin City, and provide them with a safe and healthy working environment. To achieve the goal of labor protection, Panjin City has established and improved mechanisms for labor rights protection and supervision, and safeguarded the legitimate rights and interests of workers. The first strict admission system requires any unit or organization to hold legal certificates and licenses when recruiting workers, formulate recruitment brochures, and conduct recruitment through legal channels such as publishing information, entrusting human resources service agencies, or participating in recruitment negotiations. Secondly, for labor registration, if the employer has established a labor relationship with the employee, a register of employees should be established for future reference; The relevant termination and modification of labor contracts should be filed in a timely manner. Thirdly, we will adhere to daily inspections and special law enforcement inspections, and conduct strict written material reviews and inspections on whether the employing units comply with the prohibition of child labor, special labor protection for female and underage workers, regulations on working hours and rest and vacation, payment of wages to workers, and implementation of minimum wage standards. The fourth is to implement a system of publicizing rights protection, setting up or posting worker rights protection signs in labor workshops to inform workers of their legal rights and ways to protect their rights. Fifth, clarify the relevant responsibilities of each government department and establish a coordinated supervision system. Establish a social disclosure system for major violations of labor security, comprehensively publicize and implement labor security laws and regulations, strengthen social supervision, and enhance the deterrent power of labor security supervision.

742. In terms of GBV management, Panjin City has taken multiple measures, starting from the physiological reality of female employees, to regulate multiple rights and interests such as pregnancy, maternity leave, and menstrual protection, effectively safeguarding the legitimate rights and interests of female employees and reducing gender based labor discrimination. According to the Special Regulations on Labor Protection of Female Employees in Liaoning Province, in terms of protecting the reproductive rights of female employees, employers shall not agree with female employees in labor (employment) contracts to restrict their legitimate rights and interests such as marriage and childbirth; It

is not allowed to reduce the salary and welfare benefits of female employees, restrict their promotion, evaluation of professional and technical positions, dismiss female employees, or unilaterally terminate labor (employment) contracts due to reasons such as marriage, pregnancy, maternity leave, breastfeeding, etc.; In terms of protecting female employees from workplace sexual harassment, employers are required to take effective measures based on their own work and production characteristics to prevent and stop female employees from being sexually harassed in the workplace. If female employees are subjected to sexual harassment or other behaviors that endanger their personal safety in the workplace, and report or complain to the employer, the employer shall promptly handle it and protect the personal privacy of female employees in accordance with the law. At the same time, female workers should be encouraged to firmly defend their personal rights, and work together with the Panjin Women's Federation to provide consulting services, set up exhibition boards, participate in legal knowledge competitions, conduct door-to-door publicity, distribute prevention and legal publicity materials, and promote knowledge and relevant laws and regulations on preventing and eliminating gender based violence to the general public, eliminate gender based violence, and promote the development of a healthy, civilized, and harmonious society. The hotline of Panjin Women's Federation is 0427-3380020/12338.

743. It is recommended that the construction unit meet the following 5 requirements:

(1) Based on the principles of equal opportunity and fair treatment, the employment of project staff shall not discriminate against specific groups such as women, people with disabilities, migrant workers, and legally required working age youth.

(2) Provide appropriate protection and assistance measures, including establishing restrictions on working hours and rest time, establishing a vacation system, and protecting the safety and health of workers from a time perspective. At the same time, sufficient and complete labor protection equipment should be reasonably equipped according to construction needs, hazardous factors in the construction site, and labor safety and hygiene requirements. Taking care of specific groups of workers, such as women, people with disabilities, migrant workers, and legally required working age youth.

(3) 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.

(4) To prevent the occurrence of sexual harassment incidents, the contractor will set up sufficient gender segregated facilities in the temporary toilets on the construction site based on the number of female staff; Develop relevant regulations to prevent sexual harassment and assign dedicated personnel to be responsible, clearly informing all personnel of the relevant requirements; The contractor's daily management training will include relevant content on preventing sexual harassment.

(5) Establish and clarify a complaint mechanism for handling labor complaints, establish a 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 complaint mechanism of this project, please refer to Chapter 11 Grievance Redress Mechanism of this report.

12 Environmental and Social Management Plan

744. According to the results of the environmental and social impact assessment of this project and after full consultation and discussion with relevant institutions and residents in the project area, a practical environmental and social management plan has been formulated to address the impacts and possible risks of this project on the environment, society, and women. It specifies the implementation time, budget, and implementation and supervision agencies of various measures, and sets monitoring indicators and monitoring frequencies to monitor the implementation effects of corresponding measures, so as to formulate and take necessary actions in a timely manner to strengthen or adjust the measures to ensure that the established environmental and social goals of the project are achieved.

12.1 Institutional arrangements and responsibilities for environmental and social management

745. To ensure the smooth implementation of the project's environmental and social management work and achieve the expected results, a set of organizational structures must be set up during the project implementation process to facilitate environmental and social action planning, implementation, coordination and monitoring.

746. To ensure the completion of preparation and the smooth implementation, the Panjin Municipal Government has established a Working Group of Liaoning Panjin Urban Climate Resilience with Nature Based Approaches for Sustainable Municipal Service Infrastructure, and the PMO has been set up under the Working Group. The Director-General of the House and Urban-Rural Development Bureau and the President of the PMCG are the director of the PMO.

747. The PMO is responsible for the overall project collaboration and implementation in a planned manner, communication and contact with Panjin government departments and related agencies, to ensure that the project can gain the necessary policy supports and collaboration rapidly on the key processes such as planning approval, land permission, EIA, resettlement and demolition as well as construction permission, etc.

748. The PIU is the PMCG, which is responsible for the project implementation in contract procurement and management, construction quality management, financial disbursement, AIIB safeguard policy implementation and performance management and other works in a planned manner during the implementation period, in order to ensure the project implementation aligned with the AIIB policies and related regulations.

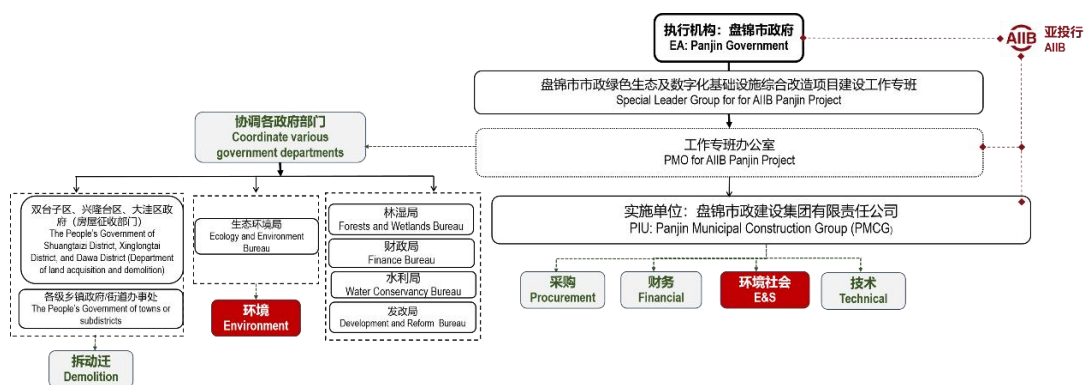


Figure 12-1 Organization Chart for Environmental and Social management

749. The implementation unit is the primary responsible entity for environmental and social management during the construction period and is responsible for the implementation of the environmental and social management plan. The main responsibilities of each relevant agency are as follows. The PIU will hire an external environmental and social monitoring unit to monitor the environmental and social performance during the implementation of the project. The operation and maintenance unit of this project is also Panjin Municipal Group, so Panjin Municipal Group will continue to be responsible for environmental and social responsibilities during the operation period.

750. The PIU will use the AIIB loan funds to hire a project management consulting company for support. The environmental and social experts of the project management company will assist the implementation unit in fulfilling their responsibilities in environmental and social risk management. Table 12-1 summarizes the implementation responsibilities of each party.

Table 12-1 Environmental and social implementation responsibilities

Institution	Responsibilities
Working Group of Liaoning Panjin Urban Climate Resilience with Nature Based Approaches for Sustainable Municipal Service Infrastructure (Working Group)	<ul style="list-style-type: none"> • Provide monitoring and guidance for overall project preparation and implementation ; • Address key problems affected project preparation and implementation; • Share and coordinate meeting minutes with EA (Panjin People’s government);
Working Group Office (PMO)	<ul style="list-style-type: none"> • Responsible for overall project collaboration and implementation in a planned manner; • Provide guidance for the project management of PIU; • Responsible for communication and contact with Panjin government departments and related agencies, to ensure that the project can gain the necessary policy supports and collaboration rapidly on the key processes such as planning approval, land permission, EIA, resettlement and demolition as well as construction permission, etc.
PIU: Panjin Municipal Construction Group, Ltd (PMCG)	<ul style="list-style-type: none"> • Monitor the contract awards and the preparation of annual disbursement prediction in order to submit to AIIB; • Financial management works such as disbursement review, withdraw application and financial auditing ; • Ensure the implementation of ESMP and safeguards and internal monitoring and reports, and submit related monitoring reports and assessment reports to AIIB; • Conduct project performance management and monitoring; • Submit the progress report and project completion report to AIIB; • Hire the procurement agency; • Design all civil works engineers of all infrastructure subprojects by the help of design institute, procurement agency and supervision company, and conduct contract procurement of civil works and goods, manage all contractors and supplier; • Conduct contract management, construction supervision and quality control by the help of supervision company; • Receive the payment application from contractors, prepare withdraw application draft after supervision; • Organize the project verification; • Operate and maintain of all project facilities.
Facility Operation and Maintenance Unit (Panjin City)	<ul style="list-style-type: none"> • Environmental and social management during operation.
Contractor	<ul style="list-style-type: none"> • Ensure adequate funding and manpower to implement the mitigation measures in the Environmental and Social Management Plan throughout the construction phase; • Developing a site environmental and social management plan; • Operation of the grievance mechanism during the construction phase.
Construction supervision company	<ul style="list-style-type: none"> • Ensure that there is sufficient funding and manpower to supervise and direct contractors, including at least an environmental officer and an occupational health and safety officer, to require contractors to implement mitigation measures as required in the environmental and social management plan; • Supervise the contractor's environmental and social management plan implementation performance and submit the "Environmental and Social Management Plan Monitoring Report" to the project implementation unit every month. ; • Implement construction supervision and quality control; • Monitor the contractor's environmental and social management plan implementation performance; • Use basic handheld equipment to conduct simple on-site quantitative measurements to regularly check whether construction meets environmental monitoring pollutant emission standards.
External monitoring unit	<ul style="list-style-type: none"> • Monitor the environmental and social management performance during the implementation period, and submit environmental and social monitoring reports to the Panjin PMO and AIIB every six months.

12.2 Environmental and social mitigation measures

751. Tables 12-2 to 12-4 list specific environmental and social mitigation measures to avoid and mitigate the adverse environmental and social impacts of the implementation and operation of this project. The design unit and contractor will incorporate the mitigation measures into the design, bidding documents,

contracts, and operation management under the supervision of the PIU and the supervision company. The effectiveness of these measures will be evaluated based on the monitoring results of the supervisor and external monitoring units to determine whether these measures need to be adjusted and improved.

752. Wetland restoration and conservation project is significantly different from infrastructure projects such as pipelines, pumping stations, and roads in terms of ecological impacts and management needs, so their specific impacts and mitigation measures are listed separately. The main impacts of infrastructure projects are mostly concentrated in short-term disturbances during construction, such as noise, dust, traffic interference, and soil erosion; while wetland restoration and conservation project achieves ecological benefits by promoting habitat restoration and improving biodiversity. Specific mitigation measures must be taken at all stages of design, construction, and operation to minimize disturbances to sensitive species and ecosystems such as wetland birds, vegetation, and aquatic organisms. Based on the ecological functions of wetlands and species protection needs, in addition to the generic environmental impact mitigation measures table applicable to all projects, it is also necessary to formulate specific measures table (specific measures).

12.2.1 Reduce Land Acquisition Risks

753.a. Based on the impact of project immigration, a resettlement action plan has been developed; b. In the implementation of the immigration action plan, special attention should be paid to how vulnerable groups such as female household heads, low-income households, and five guarantee households (if any) can use resettlement compensation to restore their income.

12.2.2 Potential Other Social Risks

754. Specific measures or actions to address potential social risks include:

a. Refer to the Environmental Management Action Plan for the impacts on the atmosphere, dust, wastewater, solid waste, etc.;

b. 1) Prior to the commencement of the project, the project implementation agency shall hold a joint meeting with the street offices and communities along the project route to coordinate; 2) Announce in the construction section one week in advance, and publicize project construction information on the project site, news media, official account of the Urban Management Bureau website, community WeChat group, etc.; 3) Maintain a smooth channel for project appeals.

c. Ensure that the operations on the construction site comply with relevant laws and regulations on labor safety in the People's Republic of China, including wearing necessary personal safety protective equipment such as safety helmets at the construction site; And COVID-19 protective equipment, such as masks, thermometers etc.;

d. Reasonably arrange construction time to reduce noise, dust, waste residue, and exhaust emissions caused by construction machinery and material transportation vehicles during project construction activities.

755. The monitoring indicators for specific measures include:

a. Monitoring the implementation of the environmental management plan;

b. Legitimate and compliant project construction information disclosure board, project public opinion solicitation record, and project emergency plan publicity board;

c. The project bidding documents and contract must include environmental security and safety measures, as well as the implementation of epidemic prevention and control measures; Record the number and specific situation of cases of violations of labor safety related laws and regulations on construction sites; The type and quantity of dust reduction measures taken at the construction site;

d. The frequency and content of complaints from surrounding residents about being severely disturbed, such as night work, dumping construction waste causing sewer blockages, etc.;

12.2.3 Impact of Foreign Workers

756. Specific actions or measures to address the impact of migrant workers include:

a. Establish a communication platform, strengthen public security management, set up regular

communication meetings between construction sites and residents, increase patrol frequency in the construction area and surrounding areas, organize safety training for migrant workers, and enhance their legal awareness.

b. Carry out health education activities to enhance the awareness of disease prevention among migrant workers, strengthen vaccination and health checks during construction period; Set up temporary medical service points and conduct regular hygiene inspections on drinking water and household waste disposal.

c. Reasonably allocate water, electricity, and food resources, reduce pressure on local resources, establish an effective system for collecting and treating household waste, and encourage the reduction of disposable product use.

757. Clearly stipulate the principle of equal opportunity and fair treatment in the employment process for project staff, and prohibit discrimination against personal characteristics unrelated to inherent job requirements, such as age and gender restrictions on applicants.

758. The monitoring indicators for specific measures include:

a. The frequency and record photos of security patrols, the frequency and record photos of labor safety training, participation in safety education lectures, and the complaint handling mechanism;

b. The frequency and number of participants in health education activities, the setting of temporary medical rooms, health promotion materials, and health check ups;

c. Regularly monitor resource consumption, amount and frequency of household waste generation and disposal, as well as photos of environmental protection promotional materials;

d. The proportion of special groups such as women and people with disabilities among employed workers, as well as the proportion of each age group.

12.2.4 Impact on Traffic Safety

759. Specific actions or measures to address the impact on traffic safety include:

a. Public disclosure of construction information and regular updates on progress, with detailed project information disclosed in advance to ensure residents' right to know and enable them to respond in advance.

b. Reasonably plan the routes of large vehicles and conduct off peak travel.

c. Improve traffic signs, strengthen traffic safety publicity in construction areas, increase traffic diversion plans, and set up temporary passages.

d. For road sections that require deep excavation, develop detailed construction detour plans and add clear safety warning signs and obstacle reminders.

e. Timely repair the damaged road surface caused by construction, avoid traffic congestion caused by construction, and strictly inspect the road section after construction to ensure quality.

760. The monitoring indicators for specific measures include:

a. Records and photos related to the frequency and scope of information disclosure, feedback from residents, etc.

b. Traffic sign coverage, traffic diversion plan, and number of staggered travel time signs.

c. Changes in vehicle and pedestrian traffic flow.

761. Traffic safety promotion and education, including the quantity of brochures, posters, and photo albums; Number of training lectures and number of participants; Distribution location and photos of community road signs.

12.2.5 Risk of incomplete construction before flood season

762. Specific actions or measures to address the risk of incomplete construction before the flood season

include:

- a. Solidly prepare for the flood season, carry out flood season publicity, and establish flood awareness; Conduct flood prevention training and drills in various forms;
- b. Organize relevant personnel to conduct a comprehensive investigation before the flood season, formulate handling measures for the problems found, and eliminate them within a time limit. For historical legacy problems that cannot be solved temporarily, emergency flood control measures should be formulated;
- c. Check and verify the flood prevention materials prepared by the construction team and the public, make up for any deficiencies, and properly store them;
- d. Revise and improve flood control plans, ensuring their operability based on actual situations;
- e. Appropriately increase the proportion of labor to ensure the progress of the project;

763. The monitoring indicators for specific measures include:

- a. The number, number of participants, and proportion of female participation in education and training related to thematic flood control and drainage;
- b. Diversified disaster training content (earthquake disaster prevention, urban flood control, inland river flood control, etc.);
- c. Regularly check the learning effectiveness of trainees and conduct indicator assessments;
- d. Develop and clarify the management process for the reserve of disaster relief materials and the use of disaster relief funds.

12.2.6 Risk of insufficient participation of vulnerable groups

764. Specific actions or measures to address the risk of insufficient participation of vulnerable groups include:

- a. Increase the participation of low-income population in this project, such as the form of WeChat, Douyin, etc.;
- b. Provide employment opportunities for low-income populations during the construction process, such as low skilled positions;

765. The monitoring indicators for specific measures include:

- a. The frequency and proportion of low-income population participating in project information dissemination and discussion;
- b. The number and proportion of low-income population among construction workers.

12.2.7 Gender Action Plan

766. In order to enhance women's abilities in employment, development, and participation, and reduce the risk of gender based violence in the participation process, construction contractors and project offices have fully consulted with women's federations and community grassroots units, and taken the following social gender action measures:

767. Reduce the risk of gender based violence:

- a. The contractor shall appoint a specialist responsible for safeguarding women's rights and develop a system and implementation plan to prevent and stop female employees from being sexually harassed in the workplace;
- b. Provide regular psychological counseling and training on protecting the rights and interests of female workers;
- c. Strengthen the supervision of construction sites to avoid harmful behaviors such as gender violence, sexual exploitation and abuse, and sexual harassment;
- d. Establish clear channels for appeals and complaints, set up a construction site appeal and complaint team, which should include at least two female members, and ensure the safety of the members of the appeal and complaint team to avoid bias and fear of retaliation.

768. Increasing employment opportunities for women:

a. During the construction and operation of the project, priority will be given to providing technical and non-technical positions for women in the villages and groups involved in the project area. b. For jobs that do not require high physical strength, the employment age range should be appropriately relaxed, and priority should be given to women aged 40 to 50 who have difficulty finding non-agricultural employment opportunities, such as cleaning, cooking, management and other jobs.

769. Enhancing women's development capabilities:

a. By organizing employment knowledge lectures, skill knowledge training courses, and employment entrepreneurship seminars, we aim to enhance women's skills, knowledge, and opportunities in employment and entrepreneurship. b. In the training of flood control and disaster reduction, as well as sustainable information disclosure capacity building, appropriate skills training content and training time should be provided based on factors such as women's physiological and psychological qualities, education level, and personal needs, further ensuring that women have equal opportunities with men to improve their skills.

770. Expand women's participation in decision-making:

a. Increase the proportion of female participation in decision-making related to community affairs; b. Increase the proportion of women signing or "both spouses jointly signing" land acquisition or demolition compensation agreements.

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771. After full consultation with the PMO, the client, the PIU, relevant agencies and residents in the project area, practical and feasible environmental mitigation measures and social management plans have been formulated in response to the impacts and possible risks of this project on the environment, society and women. See the table below for details.

772. To effectively enhance the operability of the ESMP during the project implementation process, this section classifies the environmental mitigation measures based on three different stages: (i) design and construction preparation stage; (ii) construction stage; and (iii) operation stage. To further refine the sorting, the measures are presented in separate tables according to the general measures, measures for component 1, and measures for component 2. For details, please see the relevant tables below.

Table 12-2 Environmental mitigation measures proposed during the design and construction preparation phase (general)

Item	Mitigation measures and/or safeguards	Implementation unit	Supervisor	Budget (RMB)	Monitoring indicators
Detailed design and construction preparation phase					
Updates to ESIA and ESMP	<ul style="list-style-type: none"> •If there are major changes to the design, the PMO must first inform AIB of the changes and consult AIB. If AIB approves the changes, the PIU must revise the ESIA and ESMP and submit them to the relevant local government management agencies and AIB for approval and disclosure. 	PIU, PMC	AIB Panjin Ecological Environment Bureau	-	Approved updated versions of ESIA and ESMP
Environmental and social mitigation measures	<ul style="list-style-type: none"> •Incorporate environmental and social mitigation measures into project design, and reduce negative environmental and social impacts through technology, process optimization, and construction organization planning. 	Design Institute (DI)		Included in the DI's contract	Detailed Design
Bidding documents and contracts	<ul style="list-style-type: none"> •Incorporate the requirements in term of preferring to hire local labor especially vulnerable groups in the bidding document requirements and civil works contracts; •Incorporate environmental and social mitigation measures in bidding documents and civil works contracts. 	Procurement Agent PIU	PMO	-	Environmental and social mitigation measures in bidding documents and civil works contracts
Environmental Management Institution	<ul style="list-style-type: none"> •The PMO and the PIU have assigned full-time personnel to carry out environmental and social management and coordination. If there are any changes in staffing, the PIU should report to AIB in the progress report. 	PMO PIU	AIB	-	Environmental and social personnel in place
Environmental and social external monitoring units	<ul style="list-style-type: none"> •Prior to construction, hire an external environmental and social monitoring unit ; •Develop a detailed environmental and social monitoring plan based on the monitoring plan identified in the ESMP. 	PIU	AIB	-	Environmental and social external monitoring units in place
Project Management Consulting Company (PMC)	<ul style="list-style-type: none"> •The PMC will be engaged to provide project management support to the PMO, including environmental and social aspects. 	PIU	AIB	-	Hiring and mobile a PMC
Trains for project staff	<ul style="list-style-type: none"> •Training on construction environmental and social management provided by the project management consultant or invited environmental and social experts and/or officials of the provincial or local Housing and Urban Rural Development Bureau, and training on implementation and supervision of environmental and social mitigation measures provided by contractors and supervision companies 	PIU PMC expert	AIB	Included in the PMC contract and the training cost budget for this project	<ul style="list-style-type: none"> a. Provide gender awareness and project management training to 30 staff members of the PMO and PIUs, 20% of whom are women. b. Provide ESMP and GAP training to 30 staff

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Item	Mitigation measures and/or safeguards	Implementation unit	Supervisor	Budget (RMB)	Monitoring indicators
	<p>in accordance with the training plan in this ESMP;</p> <ul style="list-style-type: none"> Implement management consultants or invited social/land acquisition and resettlement experts or independent monitoring and evaluation agencies to provide training on RAP, gender awareness and gender participation plans, public participation plans, grievances redress mechanisms (GRMs), and internal and external social monitoring and evaluation. 				<p>members of the PMO and PIUs, 20% of whom are women.</p>
<p>Establish and maintain an effective grievance redress mechanism (GRM)</p>	<ul style="list-style-type: none"> An independent worker complaint handling center is established to handle complaints from workers working on construction sites against contractors. The center sets up a grievance committee to handle any complaints from construction workers, including those directly or indirectly involved. The members of the grievance committee include: environmental and social personnel of the PIU, supervision engineers, workers, contractors and supplier representatives. The contact information of various complaint channels shall be disclosed on the implementing unit's website and on the information display board of each construction site. Record grievances and complaints raised by affected persons and other stakeholders. Document the solution. 	<p>PIU Engineering and supply chain contractors</p>	<p>PMO</p>	<p>/</p>	<p>Establishing and disclosing GRM; Number of complaints received and recorded by gender, age, occupation; Record appeal resolved.</p>
<p>Project Information Disclosure</p>	<ul style="list-style-type: none"> Before the project starts, the PIU will hold a meeting and coordination with the sub-district offices and communities along the project line; an announcement will be made at the construction section one week in advance, and the project construction information will be disclosed at the project site, news media, the Urban Management Bureau's website public account, and community WeChat groups. Before project evaluation, the ESIA, ESMP, and RAP are publicly displayed on the websites of the municipal government, the Ecological Environment Bureau, and the AIIB website. Before construction, the PIU should hold meetings with affected enterprises and communities to disclose detailed project information, and 50% of the participants should be women. 	<p>PIU</p>	<p>Supervision departments, GRM departments, trade unions, etc.</p>	<p>4,000</p>	<p>Legal and compliant project construction information display board, project public consultation record, display board of project emergency plan;</p>
<p>Stakeholder</p>	<ul style="list-style-type: none"> Identify project stakeholders, including affected and 	<p>The PIU, with the</p>	<p>PMO, AIIB</p>	<p>/</p>	<p>Types of consultations</p>

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Item	Mitigation measures and/or safeguards	Implementation unit	Supervisor	Budget (RMB)	Monitoring indicators
Engagement Program	<p>interested parties;</p> <ul style="list-style-type: none"> •Develop engagement activities for target stakeholders, develop communication methods, monitoring indicators and timelines; •When necessary, conduct underground utility surveys and protection to avoid interference with utility facilities. •Disclose construction activities in advance to the community and other targets through the media, considering the date and duration of the expected traffic disruption. 	support of the implementation management consultant			<p>held;</p> <p>Number of key stakeholders consulted;</p> <p>Number of residents consulted by gender.</p> <p>The developed construction organization plan</p>
Construction Site-ESMP (CS-ESMP)	<ul style="list-style-type: none"> •Each contractor shall prepare a construction site ESMP (CS-ESMP) based on this ESMP. The CS-ESMP shall include at least the following: •-site drainage and soil erosion management; •-spill control and management; •-Waste management plans (including construction and contaminated waste); •-Construction site access control plan; •-temporary traffic management scheme; •-occupational and community health and safety management programmes; •-Construction camp management plan. 	Contractor	Construction supervision company PIU	/	Develop a site-specific ESMP and approved by the supervision company and PIU
Avoid disputes caused by land acquisition and demolition	<ul style="list-style-type: none"> •The PIU held a consultation meeting before construction to resolve any issues caused by land acquisition and demolition and formulate mitigation measures 	PIU	Housing and Urban-Rural Development Bureau, Resource and Urban Planning Bureau, etc.	2,078,600	Resettlement Budget

Table 12-3 Environmental mitigation measures proposed in the design and construction preparation phase (applicable to component 1)

Item	Mitigation Measures	Implementation unit	Supervisor	Budget (RMB)	Monitoring indicators
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<p>Habitat planning and protection</p>	<ul style="list-style-type: none"> For tree-dwelling birds such as magpies, gray magpies, and northern long-tailed tits, high-density tree areas are reserved in the design project area. Local tree species (such as willows and elms) that magpies and tits like are selected to increase the density of trees and make them suitable for birds to build nests and roost. Set up core bird activity areas, especially in the center of the park or near the water body. Pay attention to avoiding tourist flow lines interfering with the core habitat during design. 	<p>DI</p>	<p>Panjin PMO</p>	<p>Included in design cost</p>	<p>Tree planting layout design drawings, core area and pedestrian path isolation design drawings.</p>
<p>Tree species and vegetation layout</p>	<ul style="list-style-type: none"> Choose tree species and shrubs that match the birds' diet, giving priority to fruit trees and berry shrubs that provide winter food sources, such as wolfberry, hawthorn, crabapple, etc., to provide birds with abundant food resources. Low-level vegetation (such as shrubs and ground cover plants) should be evenly distributed to form layered plant communities, providing birds with a more suitable foraging and hiding environment. Maintain a reasonable density so that birds can feed and roost safely. 	<p>DI</p>	<p>Panjin PMO</p>	<p>Included in design cost</p>	<p>Vegetation selection and stratification layout drawings, habitat monitoring plan.</p>
<p>Water system design and habitat protection</p>	<ul style="list-style-type: none"> For water birds and wading birds such as night herons and northern redbirds, gently sloping embankments are designed to facilitate birds getting on and off the shore, and shallow water areas are designed for birds to forage for food. Maintain the diversity of water bodies and increase wetland aquatic plants (such as reeds, calamus, lotus, etc.) to provide hiding and foraging places for birds. When designing the transition zone between water and land, ensure a wider wetland buffer zone to reduce the impact of human disturbance on water birds. 	<p>DI</p>	<p>Panjin PMO</p>	<p>Included in design cost</p>	<p>Design drawings of water bodies and buffer zones, and design drawings of revetment gentle slopes and wetland plant distribution.</p>

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<p>Habitats isolated from visitor paths</p>	<ul style="list-style-type: none"> For easily disturbed birds such as the Northern Redbird and the Kestrel, avoid designing tourist paths and bird-watching platforms close to the core bird habitats. The width and height of the pier and bird-watching platform should be able to control the scope of human activities, which will not only make it convenient for tourists to watch birds, but also reduce the disturbance to the birds. Set up guiding signs and isolation fences to clearly define the scope of tourist activities and ensure the quietness of the core habitat. 	<p>DI</p>	<p>Panjin PMO</p>	<p>Included in design cost</p>	<p>Design drawings of visitor flow and habitat isolation, and layout drawings of sign systems.</p>
<p>Habitat Lighting Control</p>	<ul style="list-style-type: none"> The park uses low-intensity, warm-colored light sources at night, with an installation height of less than 3 meters and facing downward to reduce light pollution. Clarify lighting control plans in bird activity areas, avoid high-brightness lighting, and reduce the time lights are on at night during the migration season. 	<p>DI</p>	<p>Panjin PMO</p>	<p>Included in design cost</p>	<p>Lighting design drawings, nighttime light pollution control plans, and low-light lighting location maps.</p>
<p>Noise Isolation Design</p>	<ul style="list-style-type: none"> Noise barriers such as vegetation isolation belts and soundproof walls should be set up to isolate bird activity areas from human activity areas. In particular, noise isolation belts should be designed in crowded areas such as squares and garden paths to reduce the disturbance of human activity noise on birds. 	<p>DI</p>	<p>Panjin PMO</p>	<p>Included in design cost</p>	<p>Noise isolation design drawings, soundproof walls and vegetation isolation belt planning drawings.</p>
<p>Water quality management facilities</p>	<ul style="list-style-type: none"> The wetland park is designed with rainwater collection, purification and discharge facilities in mind for the water environment needs of wetland water birds (such as night herons) to maintain the long-term good water quality of the wetland. Through engineering measures such as rainwater and sewage diversion, sedimentation tank setting, and vegetation filtration areas, the risk of pollutants entering wetland water bodies is reduced, ensuring the cleanliness of the water bodies for birds to drink and inhabit. 	<p>DI</p>	<p>Panjin PMO</p>	<p>Included in design cost</p>	<p>Design drawing of water purification facilities and distribution map of water quality monitoring equipment.</p>

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Landscape Design and Bird Conservation	<ul style="list-style-type: none"> In order to reduce the occupation of bird habitats by landscape structures, the park avoids large areas of hard pavement and tall buildings. The number and size of landscape sculptures and structures should be controlled outside the bird activity area; Consider using natural stones, small landscape sculptures and other elements that are in harmony with the natural environment to avoid excessive artificialization of bird habitats. 	DI	Panjin PMO	Included in design cost	Design drawings of landscape structures and impact assessment reports of structures in bird activity areas.
Environmental Education Facility Design	<ul style="list-style-type: none"> In combination with representative species in the bird list, such as the red kestrel and the waxwing, a popular science display area and information sign system are designed to show tourists the importance of wetland bird habitats and protection knowledge, and popularize the ecological value of birds; set up information boards and bird-watching platforms to guide tourists to scientifically watch birds and enhance public environmental awareness. 	DI	Panjin PMO	Included in design cost	Environmental education area design drawing, information sign layout drawing, bird watching platform design plan.

Table 12-4 Environmental mitigation measures during the construction period (general)

Construction period					
Air pollution	<ul style="list-style-type: none"> There should be a continuous, enclosed steel frame advertising enclosure, the height of which shall not be less than 1.8 meters; When the wind is stronger than level 4²⁹, stop soil excavation or building demolition; Construction waste should be removed in a timely manner. If it cannot be removed temporarily, measures such as covering with tarpaulin should be taken. Vehicles transporting sand, stone, cement, earth and other dust-generating materials must be tightly covered and spillage is strictly prohibited; To reduce the amount of dust, car wash stations are set up at the entrances and exits, and the speed of vehicles is limited. During the excavation process, water is sprinkled to maintain a certain humidity level in the work; Strengthen the management of backfill earthwork storage sites; Construction material transport vehicles should be equipped with spill prevention equipment as required; 	contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports

²⁹ Generally, according to the various phenomena caused by wind blowing on the ground or water, wind force is divided into 13 levels, with the lowest being level 0 and the highest being level 12. Level 4 means that the wind speed is in the range of 5.5-7.9 m / s.

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	<ul style="list-style-type: none"> For materials that are prone to generate dust, measures such as covering with dust-proof nets, spraying dust suppressants or sprinkling water should be taken, and temporary soil storage areas should be covered with tarpaulins; During the construction process, it is strictly prohibited to burn waste construction materials as fuel; When pouring asphalt, attention should be paid to changes in wind direction. Asphalt paving can only be carried out when the working area is downwind of sensitive points. 				
Sewage	<ul style="list-style-type: none"> The main wastewater from the construction of this project is vehicle washing water, and a wastewater sedimentation tank should be set up to be reused for dust reduction after oil separation and sedimentation purification; Construction materials should not be piled near natural water bodies such as Pangxieyou River to prevent them from being washed into the water by heavy rains; The domestic sewage of construction workers is discharged into environmentally friendly toilets along the route and cleaned out regularly; To ensure that water pollution control measures are implemented in the project, all project contracts should include water environment protection measures and strengthen environmental supervision during the construction period; Use advanced equipment and machinery to reduce the number of leaks, bubbling, dripping and leakage and the number of machine maintenance, thereby reducing the amount of oily wastewater generated; 	contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports
Construction waste and domestic waste	<ul style="list-style-type: none"> Domestic waste is collected and removed by the sanitation department; The soil and rocks produced by excavation can be used as roadbed fill, and the waste soil produced can be piled up in a temporary soil dump; During and after construction, any significant residual materials, waste and contaminated soil remaining on the ground should be removed and disposed of to designated locations in a timely manner. Once materials are removed to protect and stabilize the soil, any planned paving or vegetation cover of the area should be immediately carried out; Open burning of garbage at construction sites is strictly prohibited; Provide adequate waste bins, ensure they are protected from birds and vermin, and are emptied regularly; reuse and recycle materials such as pipes, wires, and wood; Hire a certified company to dispose of hazardous waste, such as used oil and paint containers. 	contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports
Noise pollution	<ul style="list-style-type: none"> Choose low-noise construction machinery and equipment; 	contractor	PIU	Included in	Implement mitigation

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	<ul style="list-style-type: none"> • Set up temporary soundproofing screens; • Reasonable layout of the construction site; • Reasonably arrange construction work time, prohibit night construction (22:00-6:00), and if night construction is necessary due to construction technology, obtain night construction permit in advance and inform surrounding companies; • Reasonably arrange the routes and times of construction transport vehicles. 		Supervision Company	the contractor's contract	measures and document them in monitoring reports
Soil erosion	<ul style="list-style-type: none"> • Construction site: The construction sites of this project are arranged in the principle of proximity, which is used for parking construction machinery and stacking materials. After the project construction is completed, temporary facilities should be dismantled in time, waste in the temporary occupied area should be cleared, and vegetation should be restored on the site. The planting method should be natural scattered planting, and local common species should be selected to reduce and compensate for the adverse effects caused by the construction; • Temporary soil dump: During the construction process, the topsoil is stripped and piled in a temporary soil dump. The ground is cleaned in time and watered appropriately. Wind and rain protection measures should be taken at the temporary dump. Tarpaulin should be used to cover the transportation process to reduce dust. The construction waste soil is used for later greening and the remaining waste soil is transported to the waste dump designated by the construction department for disposal. After the construction is completed, the site is revegetated to restore the original land use function. Local common species are selected for vegetation restoration to reduce and compensate for the adverse effects caused by the construction; • Avoid excavation and backfilling during the rainy season to prevent secondary soil erosion; • Special intercepting drainage ditches, diversion cofferdams and temporary anti-seepage sedimentation tanks should be set up at construction sites and temporary soil storage yards to divert rainwater into the sedimentation tanks and reuse it after sedimentation treatment to prevent soil erosion caused by rainwater erosion. 	contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports
Cultural Heritage Protection	<ul style="list-style-type: none"> • If cultural heritage is discovered during excavation, construction should be stopped and reported to the heritage management department to protect the site. Construction can only be continued after investigation and approval by the heritage management department; • Provide workers with awareness training on cultural and historical heritage protection. 	contractor	PIU Supervision Company Panjin Municipal Bureau of Culture, Tourism and Radio and Television	Included in the civil works contract	Implement mitigation measures and document them in monitoring reports Heritage Discovery Cases Number of workers trained (by gender); Examples of archaeological discoveries during

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					construction.
Impacts of Resettlement and Land Acquisition and Demolition	<ul style="list-style-type: none"> Implement the resettlement plan in accordance with the approved resettlement action plan; 	The governments of Xinglongtai District, Shuangtaizi District, and Dawa District of Panjin City, as well as the sub-district offices, state-owned farms, and village committees involved ;	Panjin PMO	Project Funding	Monitoring of the implementation of resettlement plans.
Worker and community safety	<ul style="list-style-type: none"> Strictly implement all national laws, regulations and guidelines regarding work safety; Establish safety signs at the construction site and on access roads; Ensure pedestrians are not blocked by vehicles entering and leaving the construction site; Assigning safety officers to direct traffic to ensure community safety; Publicizing safety measures and emergency contact information at construction sites; The operation of construction vehicles must comply with relevant safety regulations. Vehicles should be stored in designated areas within the construction site, with safety fences and warning signs; Strengthen vaccinations and health checks during construction; Provide personal protective equipment such as safety boots, helmets, gloves, protective clothing, goggles and ear protection in accordance with relevant worker health and safety regulations; An emergency response plan for accidents and emergencies, including environmental and public health emergencies related to hazardous substance spills and similar incidents, will be prepared; the plan shall be submitted to the local Environmental Protection Agency for review and evaluation. Emergency telephone links will be established with hospitals in the three project towns. A fully equipped First Aid base will be organized at each construction 	contractor	PIU Supervision Company	Included in the civil works contract	<ul style="list-style-type: none"> Implement mitigation measures and document them in monitoring reports; The number and types of complaints or grievances from local residents; The frequency and photos of public security patrols, the frequency and photos of labor safety training, the record of participation in safety education seminars, and the GRM; The frequency and number of participants in health education activities, the establishment of temporary medical clinics, health promotion materials and health

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	<ul style="list-style-type: none"> camp; Establish a communication platform, strengthen public security management, set up regular communication meetings between construction sites and residents, increase the frequency of patrols in and around construction areas, organize safety training for migrant workers, and improve their legal awareness. A records management system will be established to store and maintain easily retrievable records, protected from loss or damage. It will include recording and reporting of occupational incidents, diseases and accidents. Records will be reviewed during compliance monitoring and audits; Ensure occupational health and safety issues are highly publicized to all persons at each construction site on a regular or occasional basis. Posters will be prominently displayed in relevant areas of the site; Training all construction workers on basic hygiene, general health and safety issues, and the specific hazards of their work. Training local communities and construction workers on gender-based violence prevention; Develop and distribute a Labor Code of Conduct to workers and provide training to them; 				examinations;
Protecting workers from HIV /AIDS, COVID -19, and other infectious diseases	<ul style="list-style-type: none"> Health knowledge dissemination related to HIV, COVID-19 and other communicable diseases to contractors and affected employees in the project area to enhance their health and safety awareness. The proportion of women shall not be less than 50%. 	PIU	National Health Commission, Trade Unions, Women's Federation, etc.	20,000	Number of publicity and number of beneficiaries, etc.
Traffic disruption	<ul style="list-style-type: none"> Public disclosure of construction information and regular progress updates; Reasonably plan routes for large vehicles to avoid peak travel times; Develop a traffic diversion plan before construction and add obvious safety warning signs and obstacle reminders; Coordinate traffic management with traffic police during construction; Develop material transportation plans to reduce traffic disruptions; Set up temporary pedestrian access and provide appropriate safety measures (e.g. fencing, night lights, etc.); Repair road surfaces damaged by construction in a timely manner, avoid traffic congestion caused by construction, and conduct strict acceptance inspections of road sections after construction to ensure quality. 	contractor	PIU, supervision company	Included in the civil works contract	<ul style="list-style-type: none"> Implement mitigation measures and document them in monitoring reports Construction organization plan before construction starts; The number and types of grievances or complaints regarding traffic safety issues filed by the project-affected persons and groups. The number and type of traffic safety awareness programs held and the number of participants, disaggregated by gender;

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					<ul style="list-style-type: none"> Traffic sign coverage rate, traffic detour plans and number of signs indicating staggered travel times.
Stakeholder Engagement	<ul style="list-style-type: none"> Establish a notice board at the construction site to inform project information, safety and environmental protection measures, fire and site safety measures, management personnel and GRM telephone numbers; Establish and maintain environmental and social safeguards GRM and keep records; Release project information through the media; Pay attention to the opinions of vulnerable groups (such as women and poor groups) to ensure that the project is open, fair and transparent; Conduct training on the GRM, public consultation methods, communication skills, and monitoring methods. 	contractor PIU	PMO Supervision Company AIIB	Included in the civil engineering contract and the operation and maintenance costs of the PIU	Public complaint records, training records
Labor and working conditions	<ul style="list-style-type: none"> Strictly comply with the requirements of the Labor Law and the Labor Contract Law and include labor protection provisions in contracts; Clearly stipulate that the principles of equal opportunity and fair treatment should be adhered to in the hiring process. In addition, no discrimination should be made against personal characteristics that are not related to the inherent job requirements, such as restrictions on the applicant's age or gender; Hire labor in accordance with relevant laws and regulations; Signing labor contracts with workers; Provide labor health and safety measures and equipment; Provide labor rights protection-related legal and rights protection knowledge and skills training, with no less than 50% of participants being women; Establish and publicize a labor GRM; Providing employment opportunities for the local workforce, with a special focus on women and low-income people from disadvantaged groups; Ensure that workers have access to basic insurance, that wages are paid on time, and that men and women receive equal pay for equal work. 	Engineering and supply chain contractors	PMO Supervision Company Human Resources and Social Security Bureau, etc.	Included in the civil works contract	<ul style="list-style-type: none"> Labor protection provisions in employment contracts Labor complaint records; Total number and proportion of female workers with labor contracts by gender ; Number of women employed; The amount and type of safety equipment provided to workers. Amount and type of safety training. Number of workers trained by gender.
Reduce the impact of the project on local businesses and employees	<ul style="list-style-type: none"> Shorten the construction period as much as possible; Reasonably arrange construction time to avoid noise and dust impact on residents; Properly arrange entrances and exits along the fence to ensure community transportation Employment opportunities will be provided to those affected, especially those whose businesses may be affected or whose 	Contractor	PIU Supervision Company AIIB	Included in the civil works contract	Number of local employees

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	<ul style="list-style-type: none"> income will be reduced in some way; Establish and improve the management system for migrant construction workers to prevent the influx of migrant workers from affecting community safety. 				
Avoid conflicts with surrounding communities and residents (outside the project area)	<ul style="list-style-type: none"> Make project details public to non-local residents and provide the same skills training. 		Human Resources and Social Security Bureau, etc.	2,000	Number of training sessions on local social customs and practices, number of participants, and on-site photos
Disruption of utility services	<ul style="list-style-type: none"> Assess construction sites in advance to prevent service disruptions and identify risks before construction begins; If temporary disruptions are unavoidable, work with relevant local agencies such as power companies and water companies to develop plans to minimize disruptions and inform all affected people of the disruption date and duration in advance. 	Contractor PIU	PMO Supervision Company	Included in the civil works contract	<ul style="list-style-type: none"> Number of disruptions and complaints Residents' satisfaction with the solution
Risks of not completing construction before the flood season	<ul style="list-style-type: none"> Make solid preparations before the flood season, carry out publicity during the flood season, and raise awareness of flood disasters; carry out flood prevention training and drills; Before the flood season, relevant personnel should be organized to conduct a dragnet inspection, formulate treatment measures, and eliminate them within a time limit. For historical problems that cannot be solved for the time being, emergency flood control measures should be formulated; Conduct inventory and verification of flood control materials; Revise and improve flood prevention plans; Appropriately increase the labor ratio to ensure the progress of the project; 	Contractor PIU	PMO Supervision Company, Emergency Management Bureau	Included in the civil construction contract and the operation and maintenance costs of the PMO	<ul style="list-style-type: none"> The number of educational trainings on special flood prevention and drainage, the number of participants, and the proportion of female participants; Diversified disaster training content (earthquake disaster protection, urban flood control, river flood control, etc.); Regularly check the learning effect of trainees and conduct indicator assessment; Formulate and clarify the management process for the storage of disaster relief supplies and the use of disaster relief funds.
Attract local labor to participate in construction	<ul style="list-style-type: none"> Contractors provide local information on temporary employment needs and qualification requirements; 1,000 local laborers were hired for construction, 10% of the employees shall be women and 10% shall be low-income residents. Increase the number of ways for low-income people to participate in this project, such as WeChat and Douyin; Provide employment opportunities for low-income people during the 	Contractor	Human Resources and Social Security Bureau, Trade Union, Women's Federation, etc.	35,000	<ul style="list-style-type: none"> The number and proportion of low-income people participating in project information dissemination and discussion; The number and

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	construction process, such as low-skilled jobs;				proportion of low-income people among construction workers.
Related enterprises provide job opportunities for local residents	<ul style="list-style-type: none"> 848 temporary jobs will be provided, including jobs for women, and no less than 20% of the jobs will be for women. 	Contractor	Human Resources and Social Security Bureau, Trade Union, Women's Federation, etc.		Number of temporary employees, by gender, low-income groups, etc.

Table 12- 5 Environmental mitigation measures during the construction period (applicable to Component 1)

Item	Mitigation measures	Implementation unit	Supervisor	Budget (RMB)	Monitoring indicators
Water protection	<ul style="list-style-type: none"> Set up sedimentation tanks and isolation facilities to prevent construction wastewater from polluting water bodies, and clean the sedimentation tanks regularly; Install fences around wetland water bodies to reduce sediment loss; 	Contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports
Noise	<ul style="list-style-type: none"> Avoid construction at dawn and dusk, and nighttime construction requires a permit; Use low-noise equipment and install silencers or vibration reduction devices on high-noise equipment; Set up sound barriers in sensitive areas and monitor noise levels in real time. 	Contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports
Habitat protection	<ul style="list-style-type: none"> Control the construction scope to avoid disturbing the bird activity area; The native wetland vegetation within the construction area should be preserved as much as possible; Vegetation around the construction area should be isolated and protected to prevent heavy machinery from crushing the plants; When restoring habitat, prioritize the use of wetland native plant species to support wetland ecosystem and soil recovery and provide food and shelter for birds and other wetland organisms. 	Contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports

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Waste management	<ul style="list-style-type: none"> Waste generated during the construction process should be cleaned up and piled up in a centralized manner in a timely manner to avoid being abandoned in wetlands or near water bodies, and random stacking of construction materials should be stopped. Set up domestic waste collection facilities in the construction area to ensure that the domestic waste generated by construction workers is collected in a unified manner, and arrange for qualified units to remove it regularly. 	Contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports
Training	<ul style="list-style-type: none"> Provide wetland ecological protection training to construction workers to strengthen protection awareness and make workers understand the sensitivity of wetland ecology and how to reduce disturbance with wildlife and ecosystems. 	Contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports
Bird monitoring	<ul style="list-style-type: none"> Establish bird observation points outside the construction area to ensure that construction workers and monitoring personnel can clearly understand bird dynamics, identify potential sources of disturbance in a timely manner, and make adjustments. 	Contractor	PIU Supervision Company	Included in the contractor's contract	Implement mitigation measures and document them in monitoring reports

Table 12-6 Environmental mitigation measures during the operation period (applicable to Component 1)

Item	Mitigation measures	Implementation unit	Supervisor	Budget (RMB)	Monitoring indicators
Monitor	<ul style="list-style-type: none"> Regularly inspect bird habitats and monitor the health of the habitats. 	Facility Operation and Maintenance Unit (Facility O&M Unit)	PMO	Included in daily O&M costs	O&M records
Public Awareness Improvement	<ul style="list-style-type: none"> Public science displays and bird-watching guidance: Bird-watching guides and science display boards are set up in parks and wetland areas to rise bird protection knowledge to the public and guide and standardize bird-watching behavior. 	Facility O&M Unit	PMO	Included in daily O&M costs	O&M records

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Habitat protection	<ul style="list-style-type: none"> In areas where birds frequently appear, ecological buffer zones and bird-watching platforms should be established to guide tourists' behavior and avoid direct entry into the core habitats of birds. Set up tourist flow control mechanisms and non-visiting time periods in bird-watching areas to protect the normal life of birds. Management and maintenance of ecological habitat islands: Regularly maintain habitat islands and shallow water areas to ensure that the habitat and foraging environment provided for birds is not affected. 	Facility O&M Unit	PMO	Included in daily O&M costs	O&M records
Population structure	<ul style="list-style-type: none"> Regularly maintain the aquatic plant population structure to prevent eutrophication of water bodies and excessive vegetation density, and protect the ecological balance of water bodies. 	Facility O&M Unit	PMO	Included in daily O&M costs	O&M records
Maintenance of bird watching platforms and buffer strips	<ul style="list-style-type: none"> Carry out regular inspection and maintenance of bird-watching platforms and buffer zones to ensure that the facilities are stable and that tourist activities do not enter bird habitats. 	Facility O&M Unit	PMO	Included in daily O&M costs	O&M records
Solid waste	<ul style="list-style-type: none"> Set up adequate waste recycling facilities in the park and remove waste regularly; Add promotional signs in key areas to encourage tourists to travel in a civilized and environmentally friendly manner; Carry out daily inspections and garbage removal to avoid secondary harm to birds caused by plastic bags and other hazards. 	Facility O&M Unit	PMO	Included in daily O&M costs	O&M records
Park Facilities	<ul style="list-style-type: none"> Introduce bird-friendly urban facilities: Install facilities such as drinking pools and food drop-off points to support birds' daily activities and further enhance the biodiversity of the wetlands. 	Facility O&M Unit	PMO	Included in daily O&M costs	O&M records
noise	<ul style="list-style-type: none"> Install low noise warning signs and visitor guidance facilities in the project area; Use silent materials and equipment to reduce noise emissions during use of facilities; Regular inspections are conducted on bird watching platforms and fitness equipment areas to ensure that visitors comply with noise control requirements. 	Facility O&M Unit	PMO	Included in daily O&M costs	O&M records

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Light pollution	<ul style="list-style-type: none"> Install low-lightness street lights in wetlands and park areas to reduce night brightness and control lighting hours; use directional lighting equipment in ecologically sensitive areas to avoid unnecessary disturbance with bird activities. 	Facility O&M Unit	PMO	Included in daily O&M costs	O&M records
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Table 12-7 Environmental mitigation measures during operation period (applicable to component 2)

Item	Mitigation measures and/or safeguards	Implementation unit	Supervisor	Budget (RMB)	Monitoring indicators
Operation Period					
Water pollution	<ul style="list-style-type: none"> During the design, construction and operation, strengthen management to ensure the normal operation of the pipeline network; formulate emergency plans to prevent adverse consequences when problems arise. Strengthen inspections of sewage pipelines during the operation period. During the construction of the pipeline network, inspection wells are set up at appropriate distances, and dedicated personnel are assigned to inspect and maintain the pipelines in sections; Strengthen the maintenance of the drainage system and regularly desilt the drainage system to ensure smooth drainage of precipitation. An emergency pool is built to collect sewage overflow caused by pump station accidents. After collection, the sewage is transferred into the sewage network by a lifting pump and finally reaches the sewage treatment plant for treatment. Identify engineering personnel for pipeline network operation and maintenance, and provide targeted training for professional technicians and workers; Establish an emergency accident handling mechanism and set up an emergency accident handling leading group. 	Facility O&M Unit	PMO	Included in daily O&M costs	Comprehensive Wastewater Discharge Standard (8978-1996) Water quality monitoring
Solid Waste	<ul style="list-style-type: none"> Domestic waste at the pumping station is collected and transported to the waste treatment station. Domestic waste transportation is basically realized in the form of collection containers and sealed transportation. The grill slag at the pump station is removed regularly and the sludge is transported to the sludge disposal center for treatment. Set up classified garbage bins and equip them with garbage removal equipment, and have the local sanitation department remove and dispose of the garbage in a timely manner; General garbage shall be disposed of in accordance with the regulations of the sanitation, environmental protection, urban management and other relevant departments, and solid waste shall be transported to designated locations in a timely manner. Garbage shall not be scattered, piled or transferred along the road; Regularly clear the pipelines, remove silt and slag, and entrust the sanitation department's professional transport vehicles to directly transport the solid waste and sludge blocked by the grille, and transport them immediately after cleaning without temporary storage; Clean public areas and remove fruit peels and paper scraps in a timely manner; regularly trim the branches and leaves of green plants and remove dead branches and leaves in a timely manner to prevent dead branches and leaves from falling into the river and 	Facility O&M Unit	PMO	Included in daily O&M costs	Disposal of garbage in landfill

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	<p>affecting the water environment; the sanitation department shall regularly remove and dispose of green solid waste;</p> <ul style="list-style-type: none"> Hazardous wastes such as discarded lubricating oil must not be landfilled or discarded without authorization, and must not be mixed with domestic waste for transportation; a temporary storage room for hazardous wastes should be established, and after centralized collection, they should be sent to qualified hazardous waste treatment units for treatment to avoid environmental pollution. 				
noise	<ul style="list-style-type: none"> Mechanical equipment with lower noise intensity should be given priority. Continuous noise equipment such as water pumps are placed in the factory, and sound insulation materials are installed on the inner walls of the room; equipment is installed with vibration reduction pads, shock-absorbing springs or anti-vibration pads and other facilities. The blower is in the fan room, and basic shock absorption and factory sound insulation are done well. Strengthen the maintenance of processing equipment, and oil the fan bearings and other parts in time. Operators of high-noise mechanical equipment are provided with noise-proof labor protection and their operating time is arranged reasonably. In pipeline design, attention should be paid to shock and impact prevention to reduce falling and vibration noise. Air ducts and fluid transportation should be improved to improve their smoothness and reduce aerodynamic noise. A combination of trees and shrubs will be planted around the pump station to further reduce the impact of noise generated during the operation of the project on surrounding residents. 	Facility O&M Unit	PMO	Included in daily O&M costs	Noise monitoring
Air pollution	<ul style="list-style-type: none"> During the design, sewage and sludge treatment processes and equipment with low odor emission should be used, and the odor source should be controlled through measures such as odor source isolation, corruption prevention and equipment cleaning; Strengthen management, remove screen residue and sand in the water inlet section in time, clean the screen regularly, and remove the debris removed by the coarse screen cleaner in time; When the odor concentration at the sewage plant boundary meets the emission requirements, plant liquid can be sprayed in non-enclosed operation areas to effectively remove odor and alleviate the impact of odor; Strengthen greening in the project area, plant a green belt of a certain width at the edge of the factory boundary, and select tree species that can effectively absorb odors to reduce the impact of odor pollution; Construction units should strengthen equipment and pipeline management, and strengthen on-site inspections, checks and maintenance to reduce the occurrence of accidents; Formulate a comprehensive emergency response plan for unexpected accidents and strengthen drills to ensure timely response and rescue when an accident occurs, thus shortening the impact time. 	Facility O&M Unit	PMO	Included in daily O&M costs	Air Quality Monitoring

Table 12-8 Social mitigation measures during operation (general)

Item	Mitigation measures and/or safeguards	Implementation unit	Supervisor	Budget (RMB)	Monitoring indicators
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<p>Vulnerable groups</p>	<ul style="list-style-type: none"> • Prioritize employment opportunities for disadvantaged groups and ensure equal pay for equal work; • Take the needs of low-income people into account when disseminating information, and provide targeted information guidance and training; • Clearly stipulate that the principles of equal opportunity and fair treatment should be adhered to in the hiring process. In addition, no discrimination should be made against personal characteristics that are not related to the inherent job requirements, such as restrictions on the applicant's age or gender; • Provide appropriate protection and assistance measures for specific groups of workers, such as women, persons with disabilities, migrant workers and children of statutory working age, to address project staffing deficiencies; • Gender-based violence See Gender Action Plan. 	<p>Facility O&M Unit</p>	<p>Panjin Municipal Government</p>	<p>-</p>	<ul style="list-style-type: none"> • Employ local staff during project operation; • The proportion of women, people with disabilities and other special groups among the employed workers, as well as the proportion of each age group; • Protection measures and regulations for women, the disabled, and child workers; • Implementation of the Gender Action Plan.
<p>Community Environmental Risks</p>	<ul style="list-style-type: none"> • Develop a public health emergency plan 	<p>Panjin Municipal Health Commission</p>	<p>Panjin Municipal Government</p>	<p>-</p>	<ul style="list-style-type: none"> • Contingency plans in place
<p>Public consultation</p>	<ul style="list-style-type: none"> • Establish and maintain a public consultation mechanism and arrange staff to accept public complaints and opinions to ensure the rights of project-affected persons. • Formulate a social education and training plan along the route, carry out special lectures on flood prevention and disaster relief knowledge using the heavy rain in Panjin as an example, including flood safety education and training, conduct flood prevention warnings and drills, and improve residents' awareness of flood prevention and safety; • Diversified disaster training content (earthquake disaster protection, urban flood control, etc.); • When carrying out education and training related to flood control and drainage, special attention should be paid to the proportion of women, the elderly and children attending lectures; • Actively carry out natural disaster personnel training and strengthen the construction of disaster information personnel team. 	<p>Panjin Municipal Engineering Group</p>	<p>Panjin Municipal Government</p>	<p>-</p>	<ul style="list-style-type: none"> • Public complaint records ; • The number of educational trainings on special flood prevention and drainage, the number of participants, and the proportion of female participants; • Diversified disaster training content (earthquake disaster protection, urban flood control, inland river flood control, etc.);
<p>Traffic safety risks</p>	<ul style="list-style-type: none"> • Rationally plan the traffic settings of road sections and encourage residents to travel during off-peak hours to reduce the risk of traffic jams and collisions; • Strengthen traffic safety publicity, add traffic counselors and traffic control stations to better maintain traffic order. 	<p>Project Street Community</p>	<p>Panjin PMO, Traffic Police Team</p>	<p>-</p>	<ul style="list-style-type: none"> • The planning of the road sections where vehicles are operated includes the number of road signboards and notice boards in the units and communities; • Traffic safety publicity and education,

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					including the number of brochures, posters and photo albums; the number of training seminars and the number of participants; the number of traffic control stations and counselors.
Allow relevant enterprises to provide job opportunities for local residents	<ul style="list-style-type: none"> Within six months after the project is put into operation, relevant institutions and enterprises shall provide no less than 100 new non-temporary jobs to the local area, and the proportion of women shall not be less than 40%. 	Panjin Municipal Engineering Group	Human Resources and Social Security Bureau, Trade Union, Women's Federation, etc.	-	<ul style="list-style-type: none"> Number of jobs and gender ratio of local residents

Table 12-9 Social Management Plan

stage	Specific measures or actions		Implementing unit	Supervisory Unit	Source of Funds	Monitoring indicators
Social Management Plan						
construction period	The impact of immigration and land acquisition and demolition	Implement the immigration plan according to the approved resettlement action plan;	Xinglongtai District Government, Street Office, State owned Farm, and Village Committee in Panjin City;	Panjin PMO	Project funding	Monitoring the implementation of the resettlement plan for immigrants.
	Potential risks to other societies	a. Refer to the Environmental Management Action Plan for the impacts on the atmosphere, dust, wastewater, solid waste, etc.; b. 1) Prior to the commencement of the project, a meeting will be held by the government in conjunction with street offices and communities along the project route to coordinate; 2) Announce in the construction section one week in advance, and publicize project construction information on the	contractor	Panjin PMO	Project budget	a. Monitoring the implementation of the environmental management plan; b. Legitimate and compliant project construction information disclosure board, project public opinion solicitation record, and project emergency plan publicity board; c. The project bidding documents and contract must include environmental

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stage	Specific measures or actions		Implementing unit	Supervisory Unit	Source of Funds	Monitoring indicators
	<p>project site, news media, official account of the Urban Management Bureau website, community WeChat group, etc.; 3) Maintain a smooth project appeal channel;</p> <p>c. Ensure that the operations on the construction site comply with relevant laws and regulations on labor safety in the People's Republic of China, including wearing necessary personal safety protective equipment such as safety helmets at the construction site; And COVID-19 protective equipment, such as masks, thermometers etc.;</p> <p>d. Reasonably arrange construction time to reduce noise, dust, waste residue, and exhaust emissions caused by construction machinery and material transportation vehicles during project construction activities.</p>					<p>security and safety measures, as well as the implementation of epidemic prevention and control measures; Record the number and specific situation of cases of violations of labor safety related laws and regulations on construction sites; The type and quantity of dust reduction measures taken at the construction site;</p> <p>d. The frequency and content of complaints from surrounding residents about being severely disturbed, such as night work, dumping construction waste causing sewer blockages, etc.</p>
The impact of migrant workers	<p>1 Establish a communication platform, strengthen public security management, set up regular communication meetings between construction sites and residents, increase patrol frequency in the construction area and surrounding areas, organize safety training for migrant workers, and enhance their legal awareness;</p> <p>2 Carry out health education activities to enhance the awareness of disease prevention among migrant workers, strengthen vaccination and health checks during construction period; Set up temporary medical service points and conduct regular hygiene inspections on drinking water and household waste disposal;</p> <p>3 Reasonably allocate water, electricity, and food resources, reduce pressure on local resources, establish an effective system for collecting and treating household waste, and encourage the reduction of disposable product use;</p> <p>4 Clearly stipulate the principle of equal opportunity and fair treatment in the employment process for</p>		contractor	Panjin PMO	Cost of project labor management plan	<p>1 The frequency and record photos of security patrols, the frequency and record photos of labor safety training, participation in safety education lectures, and the complaint handling mechanism;</p> <p>2 The frequency and number of participants in health education activities, the setting of temporary medical rooms, health education promotional materials, and health check ups;</p> <p>3 Regularly monitor resource consumption, amount and frequency of household waste generation and disposal, as well as photos of environmental protection promotional materials;</p> <p>4 The proportion of special groups such as women and people with disabilities among the employed</p>

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stage	Specific measures or actions	Implementing unit	Supervisory Unit	Source of Funds	Monitoring indicators
	project staff, and prohibit discrimination against personal characteristics unrelated to inherent job requirements, such as age and gender restrictions on applicants.				workers, as well as the proportion of each age group.
Traffic safety impact	<p>1 Public disclosure of construction information and regular updates on progress, with detailed project information disclosed in advance to ensure residents' right to know and enable them to respond in advance;</p> <p>2 Reasonably plan the routes of large vehicles and conduct off peak travel;</p> <p>3 Improve traffic signs, strengthen traffic safety publicity in construction areas, increase traffic diversion plans, and set up temporary passages;</p> <p>4 Develop detailed construction detour plans for road sections that require deep excavation, and add clear safety warning signs and obstacle reminders;</p> <p>5 Timely repair the damaged road surface caused by construction, avoid traffic congestion caused by construction, and strictly inspect the road section after construction to ensure quality.</p>	contractor	Panjin PMO, Traffic Police Team	Project budget, government department financial budget	<p>1 Records and photos related to the frequency and scope of information disclosure, feedback from residents, etc.;</p> <p>2 Traffic sign coverage, traffic diversion plan, and number of staggered travel time signs;</p> <p>3 Changes in vehicle and pedestrian traffic flow;</p> <p>4 Traffic safety promotion and education, including the quantity of brochures, posters, and photo albums; Number of training lectures and number of participants;</p> <p>Distribution location and photos of community road signs;</p> <p>5 Physical pictures and statistical data of damaged road surface repair.</p>
Risk of unfinished construction before flood season	<p>a. Solidly prepare for the flood season, carry out flood season publicity, and establish flood awareness; Conduct flood prevention training and drills in various forms;</p> <p>b. Organize relevant personnel to conduct a comprehensive investigation before the flood season, formulate handling measures for the problems found, and eliminate them within a time limit. For historical legacy problems that cannot be solved temporarily, emergency flood control measures should be formulated;</p> <p>c. Check and verify the flood prevention materials prepared by the construction team and the public, make up for any deficiencies, and properly store them;</p>	contractor	Panjin PMO and Emergency Management Bureau	Project budget	<p>a. The number, number of participants, and proportion of female participation in education and training related to thematic flood control and drainage;</p> <p>b. Diversified disaster training content (earthquake disaster prevention, urban flood control, inland river flood control, etc.);</p> <p>c. Regularly check the learning effectiveness of trainees and conduct indicator assessments;</p> <p>d. Develop and clarify the management process for the reserve of disaster relief materials and the</p>

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stage	Specific measures or actions	Implementing unit	Supervisory Unit	Source of Funds	Monitoring indicators
	d. Revise and improve flood control plans, ensuring their operability based on actual situations; e. Appropriately increase the proportion of labor to ensure the progress of the project;				use of disaster relief funds; e. The number and details of workers deployed during the peak period before the flood season.
	The risk of insufficient participation of vulnerable groups a. Increase the participation of low-income population in this project, such as the form of WeChat Tiktok; b. Provide employment opportunities for low-income populations during the construction process, such as low skilled positions.	Project Street Community, Contractors	Panjin PMO	Project funds, government funds	a. The frequency and proportion of low-income population participating in project information dissemination and discussion; b. The number and proportion of low-income population among construction workers.
Operation period	Potential social risks during project operation a. Develop social education and training plans along the route, conduct specialized lectures on flood prevention and disaster relief knowledge, including flood safety education and training, conduct flood warning and drills, and enhance residents' awareness of flood prevention and safety; b. Diversified disaster training content (earthquake disaster prevention, urban flood control, etc.); c. When conducting education and training related to flood control and drainage, special attention should be paid to the proportion of women, the elderly, and children attending lectures; d. Actively carry out training for natural disaster personnel and strengthen the construction of the disaster information personnel team.	contractor	Panjin PMO	Project funds, government budget	a. The number, number of participants, and proportion of female participation in education and training related to thematic flood control and drainage; b. Diversified disaster training content (earthquake disaster prevention, urban flood control, inland river flood control, etc.); c. Regularly check the learning effectiveness of trainees and conduct indicator assessments; d. Develop and clarify the management process for the reserve of disaster relief materials and the use of disaster relief funds.
	Traffic safety risks a. Reasonably plan road traffic settings and encourage residents to travel off peak hours to reduce the risk of traffic congestion and collisions; b. Strengthen traffic safety publicity, add traffic counselors and traffic command stations to better maintain traffic order.	Project Street Community, Contractors	Panjin PMO, Traffic Police Team	Project budget, government department financial budget	a. The road section planning for vehicle operation includes the number of travel road signs and notices on unit community bulletin boards; b. Traffic safety promotion and education, including the quantity of brochures, posters, and photo albums; Number of training lectures and number of participants; Number

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stage	Specific measures or actions	Implementing unit	Supervisory Unit	Source of Funds	Monitoring indicators
					of traffic command stations and persuaders.
	Labor management risk	contractor	Panjin PMO and Urban Management Bureau	Cost of project labor management plan	a. The proportion of special groups such as women and people with disabilities among the employed workers, as well as the proportion of each age group; b. Protection measures and regulations for women, disabled persons, and child labor; c. Implementation status of gender action plan.
	The risk of insufficient participation of vulnerable groups	Panjin Housing and Urban Rural Development Bureau, Project Street Community	Panjin PMO	Project funds, government funds	a. The number and proportion of low-income population participating in service-oriented positions, as well as their salary levels; b. Number of information guidance and training sessions specifically targeting low-income populations.
Gender Action Plan					
A. Reduce the risk of gender based violence	a. The contractor shall appoint a specialist responsible for safeguarding women's rights and develop a system and implementation plan to prevent and stop female employees from being sexually harassed in the workplace; b. Provide regular psychological counseling and training on protecting the rights and interests of female workers; c. Strengthen the supervision of construction sites to avoid harmful behaviors such as gender violence, sexual exploitation and abuse, and sexual harassment; d. Establish clear channels for appeals and	Panjin Housing and Urban Rural Development Bureau, contractors	Panjin PMO, Women's Federation	Project budget, government finance	a. Develop specific systems and implementation plans to prevent and stop female employees from experiencing sexual harassment in the workplace; b. 100% of female workers have received training on labor rights protection; c. Ensure that 100% of female and male workers receive equal pay for equal work, and there are no incidents of gender based violence; d. The establishment of appeal and

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stage	Specific measures or actions	Implementing unit	Supervisory Unit	Source of Funds	Monitoring indicators
	complaints, set up a construction site appeal and complaint team, which should include at least two female members, and ensure the safety of the members of the appeal and complaint team to avoid bias and fear of retaliation.				complaint channels, and the number of female members.
B. Increase employment opportunities for women	a. During the construction and operation of the project, priority will be given to providing technical and non-technical positions for women in the villages and groups involved in the project area; b. For jobs that do not require high physical strength, the employment age range should be appropriately relaxed, and priority should be given to women aged 40 to 50 who have difficulty finding non-agricultural employment opportunities, such as cleaning, cooking, management and other jobs.	Panjin Housing and Urban Rural Development Bureau, townships and streets, contractors	Panjin PMO, Women's Federation, Human Resources and Social Security Bureau	Project budget, government finance	a. Priority should be given to providing project employment opportunities for women (the baseline proportion of female workers during the construction period is about 5%, and the target value is 10%); b. Statistical table of project input workers by gender, age, and low-income status.
C. Enhancing women's development capabilities	a. By organizing employment knowledge lectures, skill knowledge training courses, and employment entrepreneurship seminars, we aim to enhance women's skills, knowledge, and opportunities in employment and entrepreneurship. b. In the training of flood control and disaster reduction, as well as sustainable information disclosure capacity building, appropriate skills training content and training time should be provided based on factors such as women's physiological and psychological qualities, education level, and personal needs, further ensuring that women have equal opportunities with men to improve their skills.	Panjin Housing and Urban Rural Development Bureau, Urban Management Bureau, Township and Street, Contractors	Panjin PMO, Women's Federation	Project budget, government finance	a. The proportion of women participating in various training programs, including noise prevention, women's rights promotion and education, employment skills training, etc. (baseline 12%, target 20%); b. Improve training on female participation in project information disclosure and management in the project area (baseline of 12%, target of 20%).
D. Expand women's participation in decision-making	a. Increase the proportion of female participation in decision-making related to community affairs; b. Increase the proportion of women signing or "both spouses jointly signing" land acquisition or demolition compensation agreements.	Panjin Housing and Urban Rural Development Bureau, Urban Management Bureau, Township and Street, Contractors	Panjin PMO, Women's Federation	Project budget, government finance	a. The proportion of women participating in project mobilization, information disclosure, policy promotion, and negotiation targeting women (baseline 12%, target 20%); b. The proportion of women signing land acquisition or demolition compensation agreements (baseline 0%, target 100%).

12.4 Construction Camp Management Plan

773. According to the communication with the Client, the construction process of this project plans to set up three construction camps, including i) Nanqian Pump Station Construction Camp, Shuangtaizi District; ii) Liaohe South Road Pump Station Construction Camp, Xilongtai District; iii) Chunjiangjie Pump Station Construction Camp. Above construction camps are located in the construction sites of the project, but the specific location and number is to be assessed and determined in the specific design period. Therefore, this Construction Camp Management Plan of this project presents in the table below, which is formulated to outline general management requirements concerning the construction camp's establishment, infrastructure, living conditions for workers, camp air and wastewater treatment, solid waste disposal, construction material storage and management, machinery/equipment use and management, labor influx management, and occupational health and safety management. Contractors should develop specific construction camp management plans based on the construction organization plan and site conditions.

Table 12-10 Construction camp management plan

No.	Items	Camp Management Plan	
1	Background	Currently the project is in the feasibility study phase, the establishment of construction camps will need to be determined by the constructor based on the construction program. If a construction camp is required, it will need to meet the requirements of this Construction Management Camp.	
2	Infrastructure	Water supply	The project area has an office area, and the domestic water supply is mainly based on the urban pipe network, which can meet the domestic water needs of the project.
		Power supply	The project area is rich in power resources, the power supply network system is relatively complete, which can be connected to the work area as the construction power supply.
3	Living conditions of workers	<ul style="list-style-type: none"> ➤ Living camps should be set up with janitorial rooms, dormitories, canteens, toilets, washroom facilities, showers, laundries, water boiler rooms or drinking water holding tanks, closed garbage cans and other adjacent houses and facilities. ➤ The living camp must be reasonably hardened, green, set up effective drainage measures, rainwater and sewage drainage is smooth, and no water shall accumulate in the site. ➤ Living camp canteens should be single-story buildings and should be kept at a safe distance from dormitories. ➤ The living camp room shall meet the requirements of resisting class 10 wind and local seismic intensity, and the fire-fighting requirements shall be carried out in accordance with the Technical Regulation for Fire Safety at Construction Sites of Construction Projects (GB50720-2011). ➤ Living camps should establish flush toilets, set up special persons in charge of them, and carry out regular flushing and cleaning and disinfection to prevent mosquitoes and flies from breeding. ➤ Dormitories need to be set up with single beds or upper and lower double beds, with a living area of not less than 2 m² per person, prohibiting workers from sleeping in bunks, leaving space for workers to store their personal belongings, keeping dormitories hygienic, clean and ventilated, and preventing summer heat and mosquitoes and flies in summer, and preventing winter cold and keeping warm in winter. ➤ Drinking water must meet the national health standards, set up temporary water points, must assign a person to supply water and special drinking buckets, it is strictly prohibited to share a vessel for drinking water. ➤ Strictly strengthen the management of labor protection for employees, equip employees with helmets, safety belts, labor clothing and other labor protection items that meet the requirements according to the regulations, improve labor conditions, and ensure the physical and mental health of employees. <ul style="list-style-type: none"> ➤ Comply with the relevant state regulations, reasonably arrange the work and rest time of employees, achieve the combination of work and rest, and pay wages and benefits on time to ensure the living needs of workers. 	
4	Camp exhaust gas treatment	<ul style="list-style-type: none"> ➤ The camp is supporting the construction of canteen, which requires that the oil smoke of the canteen be treated by high-efficiency electrostatic oil smoke purifier, which is required to meet the requirements of <i>Oil Smoke Emission Standard for Catering Industry (Trial) (GB 18483-2001)</i> and be discharged through the flue that is higher than the roof of the building. 	

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No.	Items	Camp Management Plan
5	Camp wastewater treatment	Life camp personnel life produces domestic sewage, requiring each camp supporting grease trap, septic tank, domestic sewage to take grease trap, septic tank to and other measures, after treatment to achieve the <i>Comprehensive Emission Standards for Sewage</i> level 3 standards discharged into the surrounding municipal pipeline network.
6	Camp solid waste disposal	<ul style="list-style-type: none"> ➤A number of garbage cans are set up in each construction camp, and the domestic garbage is collected by the sanitation department and sent to Panjin waste incinerator for coordinated treatment.
7	Material storage	<ul style="list-style-type: none"> ➤The canteen in the construction camp involves the use of liquefied petroleum gas (LPG), and the back-up generator at the construction site involves the use of diesel fuel, so the construction camp should be set up with storage rooms for LPG tanks and diesel fuel drums. ➤The storage room should be separated from the workers' dormitory, kept cool and ventilated, with signs prohibiting smoking and the use of open flames. ➤The storage room is arranged to be managed and inspected by specialized personnel and equipped with fire-fighting measures such as fire-fighting appliances for use. ➤The storage containers and the drums for adding diesel oil in the diesel oil storage room should be kept clean. In order to minimize the contact between diesel oil and air, it should be stored in airtight condition to reduce unnecessary inverting; if the diesel oil drums are found to be leaking, the diesel oil should be transferred to other empty drums and absorbed with sand or other inert materials in a timely manner. ➤LPG storage room requires empty tanks to be placed separately from the real tanks, and no other items shall be stored in the storage room; it is strictly prohibited to knock, collision and dragging on the ground; it is strictly prohibited to heat up the tank; it is prohibited to use the tanks upside down, and it is strictly prohibited to conduct gas between tanks; it is strictly prohibited to privately deal with and pour out the LPG in the tanks and deal with the residual liquids; if a leakage is found, identify the leakage part quickly, take effective measures to eliminate the leakage as soon as possible, and check the leakage. Take effective measures to eliminate the leak as soon as possible, check the leak should be used to brush the method of soapy water, is strictly prohibited fire leakage test; for a moment can not be immediately eliminated leakage, the tank should be quickly transferred to an open, ventilated outdoor place, set up a good guard, immediately notify the professionals to check the treatment.
8	Labor influx management	<ul style="list-style-type: none"> ➤Specify that the employment process adheres to the principles of equal opportunity and fair treatment in the hiring of project staff, and in addition, does not discriminate against personal characteristics unrelated to inherent job requirements. ➤Provide appropriate protection and assistance measures for specific groups of workers, such as women, persons with disabilities, migrant workers, and children of legal working age; assist workers in forming workers' organizations in compliance with national laws, and workers have the right to form and join workers' organizations of their choosing and are guaranteed non-interference in their collective bargaining. ➤Establishing and clarifying mechanisms for the handling of labor complaints and reports on grievances and complaints, clarifying mechanisms for the supervision of labor protection, and protecting personal privacy in accordance with the law when dealing with complaints of sexual harassment; <p>Strengthening the protection of women's labor rights and interests</p> <ul style="list-style-type: none"> ➤Provide female laborers with regular mental health counseling and training on the protection of female labor rights; ➤Construction companies should strengthen supervision of construction sites to avoid harmful behaviors such as gender violence, sexual exploitation and abuse, and sexual harassment. ➤Establish clear channels for complaints, set up a site complaints team that includes at least two female members, and guarantee the safety of the members of the complaints team to avoid prejudice and fear of retaliation.
9	Occupation Health Safety Management	<ul style="list-style-type: none"> ➤Adequate lighting is set up in office and living areas, and electricity equipment for production camps is regularly inspected, and insulation strength is measured quarterly for lightning protection, grounding protection, and transformers. ➤The use of non-standard heating and heating equipment is prohibited in the office and

No.	Items	Camp Management Plan
		<p>living areas, and the power supply must be cut off when personnel leave the office and living places.</p> <p>➤In the living area, special persons are arranged to conduct frequent inspections of the production camps as well as the living camps where fires and electricity are easily triggered to prevent fires from occurring, and fire extinguishers, etc. are deployed in accordance with the requirements of the relevant regulations.</p> <p>➤Cooks must hold health certificates, canteens should be equipped with ventilation, exhaust and sewage drainage facilities, raw and cooked food should be strictly stored and marked, and cooking utensils in canteens should be disinfected in a timely manner and stored in an orderly manner; and reliable and effective fly- and rodent-proof facilities should be configured.</p> <p>➤Flush toilets should be set up, with special personnel responsible for regular flushing, cleaning and disinfection to prevent mosquitoes and flies from breeding.</p> <p>➤Drinking water in the campsite must meet the national hygiene standards, and temporary water points must be set up with specialized water supply and special drinking buckets, and it is strictly prohibited to share a vessel for drinking water.</p>
10	Use and management of construction machinery/equipment	<p>➤The personnel, the machine and the responsibility must be clear and fixed for the use of machinery and equipment, assign specific person to manage large-scale equipment operated by many people; small-scale equipment can be set up by a person who also manages several units. Construction work must be accepted before the technical safety instructions can be operated; and must be licensed to operate.</p> <p>➤Operators check the condition of the equipment before the shift, keep the internal and external appearance of the equipment clean, and ensure no pollution, no bruises, no corrosion, no leakage of water, no leakage of oil, no leakage of electricity, no leakage of gas.</p> <p>➤After the operation, the equipment should be parked in a safe place to prevent non-productive damage, and the spare parts and random accessories of the machinery should not be disassembled or lent out at will.</p>

12.5 Labor Management Plan

774. Based on the survey, 268 workers (about 228 men and 40 women (14.93%)) are expected to be imported from other places during the construction of the project. About 580 local workers (about 490 men and 90 women (15.52%)) (mainly porters, scaffolders, masons, cleaners, cooks, etc.). A large number of foreign workers settled in the project area to work for a long period of time, and the communication and interaction with local residents increased to a certain extent. At the same time, migrant workers will flow and consume in residential communities near the construction site and related street shops, which will cause certain social and health risks. For example, in terms of population health and hygiene, some epidemic diseases (including AIDS, novel coronavirus, influenza, etc.) have the conditions to spread and spread; At the same time, if foreigners lack understanding of the social culture and traditional habits of the project area, they may inadvertently violate the local social and cultural customs (including religious beliefs, tombs, temples, wedding and funeral festivals, etc.), which will lead to potential crises and troubles. In order to mitigate the risks posed by the influx of Labor, appropriate Labour management plans need to be developed.

Table 12- 11 Labor Management Plan

Potential Impacts	Proposed Measures	Responsible agencies	Budget (yuan)
Construction stage			
Risk on construction safety	(i) Establish and improve the construction supervision and management system, and set up construction safety supervisors at the construction site;	PIU, contractors, Department of Housing and Urban-Rural	20,000

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	<ul style="list-style-type: none"> (ii) Develop an emergency response plan; (iii) Before construction starts, use low-noise equipment and processes instead of high-noise equipment and processes when selecting construction machinery and equipment, such as low-noise vibrators, fans, electric air compressors, electric saws, etc., and install mufflers at the sound source muffled. After the construction machinery is used for a period of time, it may produce more noise, and the noise can be properly reduced through repair and maintenance; (iv) Take safe traffic control measures, set up eye-catching road signs and warnings on the construction site; limit the speed of transport vehicles, and regularly maintain vehicles and mechanical equipment to minimize the risk of accidents. (v) Truck drivers should be trained with travel safety, stipulating driving speeds, and slowing down when passing residential areas; overloading transport vehicles are strictly prohibited, and regular maintenance shall be carried out for vehicles to reduce the risk of failures causing traffic accidents; 	Development	
Risk on occupational diseases	<ul style="list-style-type: none"> (i) Establish a regular monitoring system for occupational diseases and occupational hazards; (ii) Strengthen workers' awareness of occupational health and safety, and post occupational health and safety promotional materials in conspicuous places on the construction site; (iii) Regularly organize occupational health and safety and emergency response training for workers; (iv) Provide PPE (Personal Protective Equipment) that meets Chinese national standards, including gloves, goggles, safety shoes, and provide earplugs for employees exposed to high noise environments; (v) Supervise the proper use of personal protective equipment by workers; 	PIU, contractors, Department of Human Resources and Social Security	20000
Risk on public health	<ul style="list-style-type: none"> (i) Necessary sanitation and epidemic prevention measures shall be taken for construction personnel, and regular physical examinations shall be carried out. (ii) The sanitation of food and drinking water for construction workers shall be secured; (iii) Temporary toilets set up on the construction site and toilets equipped during the operation phase should be regularly cleaned and disinfected; (iv) Carry out the publicity and education of employees' sanitation and disease prevention. Regarding seasonal epidemics, infectious diseases, etc., knowledge and methods of disease prevention and treatment should be introduced to construction personnel through broadcasting, promotional manuals, bulletin boards, and other forms; (v) Construction personnel must take health checks and quarantine before entering the site, and personnel with infectious diseases are not allowed to enter the construction team; (vi) Strengthen vaccination and health checks during construction; set up temporary medical service points 	PIU, contractors, Department of Health	20000

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	<p>and conduct regular sanitary checks on drinking water and domestic waste disposal;</p> <p>(vii) If a new infectious disease is found, the patient must be isolated and treated to cut off the transmission route to avoid spreading to the surrounding communities, and at the same time establish the health records of the construction personnel.</p>		
Risk on community security	<p>(i) Conduct legal and safety training and education for workers;</p> <p>(ii) Strengthen cooperation with public security departments and establish an irregular investigation and early warning mechanism for potential security hazards in construction camps</p> <p>(iii) Establish a communication platform, strengthen public security management, set up regular communication meetings between construction sites and residents, increase the frequency of patrols in and around construction areas, organize safety training for migrant workers, and improve their legal awareness.</p>	PIU, contractors, Department of Public Security	6000
Risk on Sexual violence	<p>(i) Set up and clear labor the worker GRM, set up worker GRM working group including at least two women members, for complaint reporting and handling, clear labor protection supervision mechanism, when dealing with sexual harassment complaints, protect individual privacy in accordance with the law;</p> <p>(ii) For female workers provide regular mental health counseling and trainings on protection of the rights and interests of women workers;</p> <p>(iii) The construction unit should strengthen the supervision of construction site, avoid gender violence, sexual exploitation and sexual abuse, sexual harassment and other harmful behavior.</p> <p>(iv) The contractor shall appoint a personnel to be responsible for the protection of women's rights and interests, and formulate a system and implementation plan to prevent and stop female employees from being sexually harassed in the workplace;</p>	PIU, contractors, Women's Federation, Department of Public Security	6000

12.6 Capacity Building of Environmental and Social Management Plan

775. Panjin AIIB PMO and PIU has no previous experience in AIIB projects, and there are no domestic requirements for this type of project such as resettlement plan, social impact assessment and social management plan, so the implementation of this Environmental and social management plan is a new task for the project implementation unit. During the implementation of the project, Panjin AIIB PIU will organize external experts to provide preliminary training on the implementation of the Environmental and Social Management Plan for the PIU, the construction unit and the supervision unit, including AIIB's Environmental and social policies, good management practices in the construction process, monitoring and reporting, appeal mechanism, etc.

776. The capacities of PIU, construction supervision company and contractor personnel will be strengthened for the implementation and supervision of ESMP. All parties involved in implementing and supervising the ESMP must understand the objectives, methods and practices of the environmental and social management in this project. The training program will also address long-term capacity building needs, covering the needs of the operational phase of the project. Training will be provided by relevant regulatory agencies (such as local Ecological Environment Bureaus) or hired experts.

777. During a long project implementation period, contractors and supervision companies are usually not hired at the same time, and are usually procured in stages during the project implementation process. In addition, there are usually personnel changes in the PIU, and training may be increased appropriately during the implementation process with the personnel changes. The training cost is estimated at 70,000 yuan.

Table 12- 12 Training plan

Training Period	Topic	Content	Frequency	Trainee	Estimated Number of People
Construction Period	Environmental and Social Policies and Regulations	<ul style="list-style-type: none"> Domestic environmental and social related regulations and policy requirements 	Once: inception stage	<ul style="list-style-type: none"> PIU; Contractors; Construction supervision companies, Other relevant parties 	30
	Implementation and adjustment of ESMP	<ul style="list-style-type: none"> Environmental and social management responsibilities during the project construction period; The main environmental and social effects and mitigation measures during the project construction period; environmental and social management monitoring and report requirements; Implementation effect and update of ESMP; Wildlife identification and protection, especially bird protection 	<ul style="list-style-type: none"> 2 times during inception stage; 1 time during project implementation 		50
	Emergency treatment	<ul style="list-style-type: none"> Emergency plan, emergency treatment measures 	Once		30
	Grievance and Dispute Resolution, stakeholder's engagement	<ul style="list-style-type: none"> GRM, including GRM structure, responsibilities and timetable, common grievance types and solutions; Requirements and plan of stakeholder's engagement during construction period 	Twice: <ul style="list-style-type: none"> 1 time during project inception 1 time during project implementation 		30
Operation period	Environment and social management	<ul style="list-style-type: none"> Wildlife identification and conservation, especially birds; Environmental and social monitoring and reporting requirements; Transportation safety and occupational health and safety; Operation and maintenance of drainage facilities; - Project environmental and social performance assessment. 	Once	<ul style="list-style-type: none"> Municipal Government; government agencies; Facility operation units; GRM acceptance point; Other relevant local institutions. 	30
Total			7		220

12.7 Environmental and Social Management Performance Monitoring and Reporting Plan

12.7.1 Monitoring Mechanism

778. The main objective of environmental and social monitoring in implementing projects is to ensure the environmental and social sustainability of the investment project, to ensure that the projects comply with the requirements of domestic environmental and social regulations and standards as well as the requirements of the AIIB's environmental and social policies, and to promote the long-term sustainable development of the regions in which the projects are located. It is necessary to enhance project transparency through monitoring and reporting to ensure that interested parties are kept informed of the project's progress and impacts. Based on the results of monitoring, it is essential to determine the need for improvement measures. The project's environmental and social monitoring mechanisms are categorized into internal and external monitoring.

779. **Internal monitoring:** The internal monitoring of the ESMP is undertaken by the PMOs and PIUs, under the assistance of environmental and social experts from the PMC during the project implementation period. They will monitor and evaluate the implementation progress of the project, the implementation of the ESMP, the progress of the stakeholders engagement plan, the complaints received and handled, the use of ESMP budget, the capacity building activities and results, and the implementation of E&S rules and regulations. The environmental and social performance monitoring results will be recorded in the environmental and social monitoring report and prepared as the appendix of the progress report, submitted to the AIIB semi-annually, and the environmental and social performance will be reviewed as part of the project completion report.

780. In addition, the construction supervision company is required to conduct frequent internal monitoring of the environment, health and safety aspects of the construction site, and report to the PIU in the monthly progress reports.

781. **External monitoring:** External environmental and social monitoring will cover the entire construction and the first year of the project operation phase. Among them, (i) the social external monitoring institution will monitor the progress of the activities described in the project documents; the satisfaction of relevant individuals or units with the project consultation or disclosure; and the resolution of various complaints caused by the project. External monitoring will be conducted through a combination of sample surveys, interviews with key stakeholders and group discussions. Relevant district agencies will be visited, and participate in public consultation meetings, evaluate the effectiveness of public participation, collect opinions, and make suggestions for improvement. The external watchdog will also review the records of the GRM to determine whether it is operating effectively. (ii) External environmental monitoring will be conducted by hiring a local qualified environmental testing organization. A preliminary monitoring program, including monitoring indicators, frequency and location, is provided in this section. The external environmental monitoring agency will develop a specific monitoring program based on the final detailed design prior to conducting the monitoring.

12.7.2 Monitoring Plan and Content

782. Based on the characteristics of this project, environmental and social monitoring plans have been developed separately for the construction phase and the operational phase, including both internal and external monitoring. The testing of environmental data should be entrusted to units with the corresponding qualifications. Environmental monitoring plans for the construction phase and the operational phase are provided in Table 12-13. Contractors and facility O&M unit should determine whether measures need to be improved according to the monitoring results.

Table 12- 13 Environmental and Social Monitoring Program

Monitoring Project	Monitoring Parameters	Sampling Location	Monitoring Frequency	Implementation Party	Supervisor	Cost Estimate (RMB)
Before Construction (Baseline)						
Ambient air quality	TSP、PM ₁₀	At the boundaries of each construction site	Before construction, 7 consecutive days	External environment monitoring agency	PIU	include in the contract of External environment monitoring agency
Acoustic environment	LAeq	At the boundary of each construction site	One-time before construction, include day and night	External environment monitoring agency	PIU	
Surface water environment	COD, BOD5, ammonia nitrogen, TP, SS, petroleum, fecal coliform group	Pangxiegou, Yitong River, Liao River	One-time before construction, 3 consecutive days	External environment monitoring agency	PIU	
Construction Stage						
Internal monitoring - supervision company, PMC, and environmental and social safeguard specialists of PIU are responsible						
Ambient air quality	<ul style="list-style-type: none"> Implementation of Mitigation Measures: Visual inspection of dust mitigation measures (watering, covering of conveyance, etc.), inspection of fencing, and maintenance of vehicles and construction equipment Performance indicator: implementation of Mitigation measures in place 	<ul style="list-style-type: none"> All construction sites 	<ul style="list-style-type: none"> Everyday; Every six months 	<ul style="list-style-type: none"> Supervision company, Environment expert of PMC 	IA	<ul style="list-style-type: none"> Included in the contracts with supervision company
Noise	<ul style="list-style-type: none"> Implementation of noise reduction measures 	<ul style="list-style-type: none"> Installation of online dust and noise monitoring devices at construction sites Municipal works at construction site boundaries 	<ul style="list-style-type: none"> Everyday; Every six months 	<ul style="list-style-type: none"> Supervision company, Environment expert of PMC 	IA	<ul style="list-style-type: none"> Included in the contracts with contractors, supervision company and PMC
Soil erosion and pollution	<ul style="list-style-type: none"> The adequacy of measures to prevent soil runoff; Adequacy of measures to prevent soil contamination. 	<ul style="list-style-type: none"> Conduct site surveys on construction sites and spoil sites 	<ul style="list-style-type: none"> Weekly; Every six months (In case of heavy rain, immediately conduct after the rain stops) 	<ul style="list-style-type: none"> Supervision company, Environment expert of PMC 	IA	<ul style="list-style-type: none"> Included in the contracts with supervision company and PMC
Solid Waste	<ul style="list-style-type: none"> Collection, storage and management of construction waste and domestic waste Performance Indicator: 100% waste is transferred at the end of the day 	<ul style="list-style-type: none"> Visual inspection of construction sites and construction camps 	<ul style="list-style-type: none"> Everyday; Every six months 	<ul style="list-style-type: none"> Supervision company, Environment expert of PMC 	IA	<ul style="list-style-type: none"> Included in the contracts with supervision company and PMC

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Monitoring Project	Monitoring Parameters	Sampling Location	Monitoring Frequency	Implementation Party	Supervisor	Cost Estimate (RMB)
Ecological environment (Birds)	<ul style="list-style-type: none"> Implementation of protection measures for birds (the specific measures are provided in Table 9-3) 	<ul style="list-style-type: none"> Visual inspection of construction sites 	<ul style="list-style-type: none"> Every day during bird migration season Spring (Mar. to May) & Autumn (Sep. to Nov.) 	<ul style="list-style-type: none"> Supervision company, Environment expert of PMC 	IA	<ul style="list-style-type: none"> Included in the contracts with supervision company and PMC
Construction site health and safety	<ul style="list-style-type: none"> Camp sanitation, issuance and wearing of personal protective equipment, safety warning signs, implementation of on-site protective measures 	<ul style="list-style-type: none"> Visual inspection of construction sites and camps, Interviews with construction workers and contractors 	<ul style="list-style-type: none"> Everyday; Every six months 	<ul style="list-style-type: none"> Supervision company Environment expert of PMC 	IA	<ul style="list-style-type: none"> Included in the contracts with supervision company and PMC
Community Health and Safety	<ul style="list-style-type: none"> Adequacy of site signs and fencing; Adequacy of temporary noise mitigation measures; Accidents involving the public and workers; Emergency situations and response; Public complaints about noise, air pollution, safety of construction sites and traffic safety, etc. 	<ul style="list-style-type: none"> Visual inspection Random interviews with surrounding enterprise employees at the construction site 	<ul style="list-style-type: none"> Everyday; Every six months 	<ul style="list-style-type: none"> Supervision company Environment expert of PMC 	IA	<ul style="list-style-type: none"> Included in the contracts with supervision company and PMC
GRM	<ul style="list-style-type: none"> Implementation of the GRM 	<ul style="list-style-type: none"> Interview affected people and workers near the construction site and check public complaint records 	<ul style="list-style-type: none"> Quarterly Semi-annually 	<ul style="list-style-type: none"> Supervision company Environment expert and social expert of PMC 	IA	<ul style="list-style-type: none"> Included in the contracts with supervision company and PMC
External monitoring - the third-party monitoring agency hired by the PIU is in charge						
Ambient Air Quality	<ul style="list-style-type: none"> TSP, PM 2.5, PM 10 Performance indicators: Liaoning Province Construction and Storage Yard Dust Emission Standard (DB21/2642-2016) 	<ul style="list-style-type: none"> All construction sites (at least one upwind and downwind) and nearby sensitive points 	<ul style="list-style-type: none"> Once a quarter, 3 consecutive days each time 	<ul style="list-style-type: none"> External environmental monitoring agency 	PIU	<ul style="list-style-type: none"> Included in the contracts with external environmental monitoring agency
Noise	<ul style="list-style-type: none"> LAeq Performance indicators: Environmental Noise Emission Standard for Construction Site Boundary (GB12523-2011) 	<ul style="list-style-type: none"> The boundaries of all construction sites, 200 m outside the boundaries, and surrounding sensitive points 	<ul style="list-style-type: none"> Once a quarter, each time for 2 consecutive days, once in the morning and evening 	<ul style="list-style-type: none"> External environmental monitoring agency 	PIU	<ul style="list-style-type: none"> Included in the contracts with external environmental monitoring agency
Overland	<ul style="list-style-type: none"> SS, COD, BOD5, ammonia 	<ul style="list-style-type: none"> Drains of 	<ul style="list-style-type: none"> Once a quarter, for 3 	<ul style="list-style-type: none"> External 	PIU	<ul style="list-style-type: none"> Included in the

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Monitoring Project	Monitoring Parameters	Sampling Location	Monitoring Frequency	Implementation Party	Supervisor	Cost Estimate (RMB)
Runoff	nitrogen, SS, dissolved oxygen, total nitrogen, total phosphorus, petroleum	construction site	consecutive days each time	environmental monitoring agency		contracts with external environmental monitoring agency
Social management plan implementation	<ul style="list-style-type: none"> The implementation process of social management 	<ul style="list-style-type: none"> Project area, surrounding areas and related units 	<ul style="list-style-type: none"> Semi-annually 	<ul style="list-style-type: none"> Social and resettlement monitoring agency 	PIU	<ul style="list-style-type: none"> Included in the contracts with external social and resettlement monitoring agency
Land acquisition and resettlement plan implementation	<ul style="list-style-type: none"> Implementation of the RP 	<ul style="list-style-type: none"> Project areas and units involving construction land, demolition of above-ground attachments, and resettlement 	<ul style="list-style-type: none"> Semi-annually (once a year after the completion of collection compensation and resettlement activities) 	<ul style="list-style-type: none"> Social and resettlement monitoring agency 	PIU	<ul style="list-style-type: none"> Included in the contracts with external social and resettlement monitoring agency
Operation stage						
Internal monitoring, environmental and social safeguard specialists of PIU are responsible						
Ambient air quality	<ul style="list-style-type: none"> The implementation of mitigation measures, including the planting and maintenance of green belts and green trees, the timeliness of road cleaning and vehicle washing 	<ul style="list-style-type: none"> Roads 	<ul style="list-style-type: none"> Once a month 	<ul style="list-style-type: none"> Facility operation and maintenance unit 	PIU	<ul style="list-style-type: none"> Included in the daily management budget of facility operation and maintenance unit
Solid Waste	<ul style="list-style-type: none"> Collection, storage and management of production waste and domestic waste, collection and treatment of hazardous solid waste 	<ul style="list-style-type: none"> Pump station 	<ul style="list-style-type: none"> Once a month 	<ul style="list-style-type: none"> Facility operation and maintenance unit 	PIU	<ul style="list-style-type: none"> Included in the daily management budget of facility operation and maintenance unit
GRM	<ul style="list-style-type: none"> Implementation of the GRM 	<ul style="list-style-type: none"> Interview community, nearby affected people, check public complaint records 	<ul style="list-style-type: none"> Semi-annually 	<ul style="list-style-type: none"> Facility operation and maintenance unit 	PIU	<ul style="list-style-type: none"> Included in the daily management budget of facility operation and maintenance unit
Operation stage - the third-party monitoring company hired by the PIU is responsible						
Ambient air	<ul style="list-style-type: none"> NO2, SO2, CO, PM10, PM2.5 	<ul style="list-style-type: none"> 200 m from the road 	<ul style="list-style-type: none"> Once a quarter, each 	<ul style="list-style-type: none"> External 	PIU	<ul style="list-style-type: none"> Included in the

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Monitoring Project	Monitoring Parameters	Sampling Location	Monitoring Frequency	Implementation Party	Supervisor	Cost Estimate (RMB)
quality		centerline	time for 3 consecutive days	environmental monitoring agency		contract with external environmental monitoring agency
Odour	<ul style="list-style-type: none"> Ammonia, hydrogen sulfide, and odor concentration 	<ul style="list-style-type: none"> Pump station 	<ul style="list-style-type: none"> Semi-annually 	<ul style="list-style-type: none"> External environmental monitoring agency 	PIU	<ul style="list-style-type: none"> Included in the contract with external environmental monitoring agency
Noise	<ul style="list-style-type: none"> LAeq Environmental Noise Emission Standard for Industrial Enterprise Boundary (GB12348-2008) 	<ul style="list-style-type: none"> Pump station boundary 200 m from the centerline of the road. 	<ul style="list-style-type: none"> Twice a year, each time for 2 consecutive days, twice a day (morning and evening) 	<ul style="list-style-type: none"> External environmental monitoring agency 	PIU	<ul style="list-style-type: none"> Included in the contract with external environmental monitoring agency

LAeq = Equivalent continuous A-weighted sound pressure level

If any excess is found: (i) Immediately report to the PIU; (2) Take corresponding actions; (3) Carry out follow-up monitoring to determine whether the relevant standards are met after taking actions; (4) All problems will be included in the "Environmental and Social Performance Monitoring Report" submitted to the AIIB.

12.7.3 Reporting

783.The Environmental and Social Internal Monitoring Report includes:(i) Implementation progress of the Environmental and Social Management Plan (ESMP) during the reporting period, and improvements and corrective actions taken in response to non-compliances noted in the previous reporting period. (ii)Overall effectiveness of the ESMP implementation, including public and occupational health and safety. (iii) Environmental monitoring and compliance. (iv) Institutional strengthening and training, including training topics related to environment, social issues, health, and safety, the training audience, and a summary of the training effects. (v) Stakeholder engagement: Summarize the stakeholder engagement activities, including meetings and consultation activities, record the opinions and feedback from stakeholders, and describe how these inputs were addressed. (vi) Operation of grievance mechanism: Compile and analyze the grievances received, including the number, types, handling processes, and outcomes. (vii) Labor statistics related to the operation of grievance mechanisms: the number of workers (including subcontractor workers), nationalities, local or foreign, gender ratios, and the number of new employees. (viii) Any issues encountered during the construction and operational phases, and the related corrective actions taken, with suggestions and plans for further improvements. The environmental and social experts of PMC will assist the PIU to prepare internal monitoring report, and submit it as part of progress report to the AIIB for review and disclosure.

784.The third-party monitoring and evaluation institutions will prepare environmental monitoring and assessment reports, resettlement and social monitoring and assessment reports, including monitoring methods, monitoring processes, monitoring results and evaluation, and submit the monitoring reports (in both Chinese and English versions, the English version shall be the criterion) to the PIU and AIIB every six months.

785.If major environmental and safety incident occurs resulting in injuries or fatalities, the reporting mechanism should be immediately activated. On-site personnel must promptly notify the management, PIU, and relevant authorities, and compile a preliminary incident report within 24 hours. This report should describe the time, location, cause, and response measures of the incident. The PIU is required to prepare an accident investigation report within 48 hours and submit it to the AIIB.

786.For non-compliances identified during monitoring, contractors and facility operation and maintenance units should analyze the causes of the non-compliance and take immediate corrective actions. All corrective measures must be documented and tracked to ensure the effectiveness of the measures and continuous improvement.

Table 12- 14 Environmental and Social Reporting Program

Report Name	Prepared By	Submit To	Reporting Frequency
A. Construction period			
Construction Progress Report	Supervision company	PIU	Every month
Project Progress Report (including internal environmental and social performance monitoring)	PIU	AIIB	Every six months
External Environmental Monitoring Report External Social Monitoring Report	External monitoring company	PIU and AIIB	Every six months
B. Operation period (until completion report is completed)			
Project Progress Report (including internal environmental and social performance monitoring)	PIU	AIIB	Every six months
External Environmental Monitoring Report External Social Monitoring Report	PIU	AIIB	Every six months
C. Project Completion Report			
Environmental and Social Completion Report	PIU	AIIB	Once

12.8 Environmental and social management plan implementation budget

787.The PMO's environmental and social security officers are paid from the PIU's operational budget,

and the experts are paid from the PMO's project management consulting package, so these costs are not listed separately here.

788. Environmental and social mitigation measures implementation and management fees of 22.34 million yuan, including: 1) Civilized construction costs during the construction period, including baffling, sprinkling, building material covering, drainage ditch, sound barrier, traffic signs, etc., a total of 18.1407 million yuan, to be borne by the contractor (as part of the construction contract); 2) 3.6 million yuan for environmental and social monitoring; 3) 100,000 yuan for capacity building and training. The operation phase is the daily maintenance cost of the facility, which is borne by each PIU. 4) Recruitment of women, subsistence workers and other training meetings, public participation in the organization of implementation and complaints about the cost of about 500,000 yuan.

Table 12- 15 Detailed Budget summary of the implementation and management of the ES mitigation measures

Item	Details	Amount (10,000 yuan)	Responsible unit
Safety and civilization construction fee	Including baffles, sprinklers, building material cover, gutters, sound barriers, traffic signs, etc.	1814.07	Contractor (included in the construction contracts)
ES monitoring fee	Environmental monitoring	180	PIU
	Resettlement and social monitoring	180	
Capacity building and training fee	Capacity building and training	10	PIU
Public engagement and GRM fee	Hiring women; trainings for low-income workers; public engagement and GRM	50	PIU

13Conclusions

789.This project implements projects such as rainwater and sewage diversion, water system connectivity, and wetland ecological restoration to improve the drainage efficiency and early warning emergency capabilities of the rainwater and sewage system, achieve wetland ecological restoration, reduce the risk of waterlogging and waterlogging in Panjin City, and further reduce the risk of environmental pollution caused by sewage overflow. Ultimately, it aims to build a demonstration city of intelligent management and low impact development climate resilience.

790.During the implementation of the project, the negative impacts on the environment and society are mainly concentrated in air pollution and noise pollution during the construction period, but these impacts are temporary and controllable. By taking mitigation measures, these impacts have been effectively controlled within an acceptable range.

791.The main negative impacts of the project on the environment include the impact of noise and dust during the construction phase on sensitive targets such as communities, as well as the impact of noise and vibration on wetland birds during the construction and operation phases, and the impact of pump station noise and odors on sensitive targets in the surrounding environment. However, the report proposes a series of economically and technically feasible mitigation measures to eliminate or mitigate these environmental impacts, ensuring the effectiveness of environmental protection during project implementation.

792.The main negative impacts of the Project on society can be divided into two stages. During the implementation stage, the main social risks during the construction stage include LAR impacts, traffic safety hazards, adverse effects of construction on community life, health and cultural conflict risks brought by migrant workers, as well as gender differences and cultural relic protection issues; the operation stage may involve employment and livelihood recovery challenges after resettlement, traffic safety pressure, and gender equality issues. In response to these risks, multiple mitigation measures have been taken for the Project, including developing a resettlement plan, improving traffic guidance and safety guarantees, establishing communication mechanisms and public participation platforms, strengthening the management of migrant workers and women's rights protection, as well as cultural relic protection measures.

793.By establishing a complaint feedback mechanism and involving stakeholders, the public's right to participate in investment projects can be realized, effectively eliminating doubts and confusion about whether there are environmental issues in investment projects, thereby better ensuring the smooth implementation of investment projects.

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Appendix 1: List of resident FGDs in the project area

Survey Date	The investigated unit	Investigation time	Survey location	Investigation method and content
July 9th	Xinglongtai Terrace	10:30 AM	Xinglong Sub-district	1) Women's FGD: 6 people, 2 young people (under 30 years old), 2 middle-aged people (30-55 years old), and 2 elderly people (over 55 years old). 2) Elderly FGD: 2 people (1 male and 1 female). 3) FGD for Vulnerable Groups: 6 people (2 from impoverished households, 2 from disabled individuals, and 2 from low-income households).
		3:00 PM	Xingsheng Sub-district	
July 10th	Xinglongtai District	9:30 AM	Zhenxing Sub-district	1) Women's FGD: 6 people, 2 young people (under 30 years old), 2 middle-aged people (30-55 years old), and 2 elderly people (over 55 years old). 2) Elderly FGD: 2 people (1 male and 1 female). 3) FGD for Vulnerable Groups: 6 people (2 from impoverished households, 2 from disabled individuals, and 2 from low-income households).
July 11th	Shuangtaizi District	3:00 PM	Tiedong Sub-district	Resident FGD: 20 people, including 10 males and 10 females; Elderly FGD: 2 people (1 male and 1 female). FGD for Vulnerable Groups: 6 people (2 from impoverished households, 2 from disabled individuals, and 2 from low-income households).
July 12th	Shuangtaizi District	9:30 AM	Hongqi Sub-district	Resident FGD: 20 people, including 10 males and 10 females; Elderly FGD: 2 people (1 male and 1 female). FGD for Vulnerable Groups: 6 people (2 from impoverished households, 2 from disabled individuals, and 2 from low-income households).
July 13th	Shuangtaizi District	3:00 PM	Constructing streets	1) Women's FGD: 6 people, 2 young people (under 30 years old), 2 middle-aged people (30-55 years old), and 2 elderly people (over 55 years old). 2) Elderly FGD: 2 people (1 male and 1 female). 3) FGD for Vulnerable Groups: 6 people (2 from impoverished households, 2 from disabled individuals, and 2 from low-income households)
July 14th	Shuangtaizi District	9:30 AM	Tiedong Sub-district	Resident FGD: 20 people, including 10 males and 10 females; Elderly FGD: 2 people (1 male and 1 female). FGD for Vulnerable Groups: 6 people (2 from impoverished households, 2 from disabled individuals, and 2 from low-income households).
		3:00 PM	Shuangsheng Sub-district	
				Resident FGD: 20 people, including 10 males and 10 females; Elderly FGD: 2 people (1 male and 1 female). FGD for Vulnerable Groups: 6 people (2 from impoverished households, 2 from disabled individuals, and 2 from low-income households).

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				and 2 from low-income households).
July 15th	Dawa District	10:30 AM	Tianjia Sub-district	1) Women's FGD: 6 people, 2 young people (under 30 years old), 2 middle-aged people (30-55 years old), and 2 elderly people (over 55 years old).
		3:00 PM	Dawa Sub-district	2) Elderly FGD: 2 people (1 male and 1 female). 3) FGD for Vulnerable Groups: 6 people (2 from impoverished households, 2 from disabled individuals, and 2 from low-income households).
November 7	Xinglongtai District	14:00 PM	Xingsheng Sub-district	FGD with the state-owned farmers, with 20 participants, including 12 males and 8 females

Appendix 2: Sample Questionnaire

附件四 社会影响评价调查问卷
(每村不低于受影响人口的 20%)

调查问卷

问卷编号: _____ 调查员: _____ 调查时间: _____ 调查地点: _____
被调查者地址: 2025 区 3 镇 1 社区/村

**亚投行贷款盘锦市市政绿色生态及数字化基础设施综合
改造项目社会影响评价调查问卷**

尊敬的先生/女士:

您好!

受盘锦市亚投行项目办、盘锦市政建设集团有限责任公司和亚投行委托,项目组正在开展一项了解总体功能评价、居民对周边河道现状评价、城市生态环境影响情况、公共卫生宣传与教育、项目了解、参与、决策和影响情况,和促进居民参与的社会评估调查。您的观点非常重要,将为本项目的设计和实施提供重要参考依据。希望得到您的理解和支持。为此,需要耽误您的一些时间,请您按照真实的情况和想法填写问卷,各项答案没有对错之分,请您不必有任何顾虑。调查资料仅供研究使用,主要用于总体分析,我们将严格按照《统计法》为您的个人信息保密。

填写说明:普通选择题,答案直接在选项或空格处画“√”;
多项选择题(在题号后可以“可多选”的形式标出),请在所有符合实际的选项上画“√”;
填空题答案请在“_____”上写出。

感谢您的支持与合作!

盘锦市亚投行项目办
盘锦市政建设集团有限责任公司
亚投行贷款项目移民与社会评价工作组
2024年7月

A 总体功能评价

A1 总的来看,您对盘锦市市政水利基础设施满意吗?
1. 非常满意 2. 满意 3. 一般 4. 不满意 5. 非常不满意

A2 您认为目前周边河道功能存在的问题严重不严重?
1. 非常严重 2. 严重 3. 一般 4. 不严重 5. 非常不严重

A3 您认为目前附近河道功能方面可能存在的问题有哪些?(限选三项)

1. 河道淤积	2. 河道淤积
3. 易发生洪涝灾害	4. 沿线的湖泊(如南湖)受损严重
5. 人行过街通道或天桥受损	6. 交通堵塞
7. 水质和生态环境恶化	8. 沿线路景观破坏
9. 其他,请注明: _____	

A4 您家附近的河道存在下列问题吗?
(请在下列问题中对应的选项里选择一个,并打钩)

项目	非常严重	严重	一般	不严重	非常不严重
1. 河道防洪排涝减灾能力弱,易被冲毁					✓
2. 河道狭窄、淤堵				✓	
3. 水环境质量差					✓
4. 植被破坏,水土流失严重					✓
5. 生态涵养功能不足					✓
6. 生产生活污水乱排乱放,造成河道污染					✓
7. 补充水源不足,枯水期河道断流					✓
8. 沿河路通行设施老化,存在通行安全隐患					✓
9. 天气恶劣时,道路泥泞/湿滑					✓
10. 道路/桥梁/人行道的路况非常差					✓
11. 道路/桥梁/人行道的交通拥堵					✓
12. 沿河双向通行不便					✓
13. 其他问题,请注明: _____					

B 居民对河道现状评价

B1 周边河道发生洪涝灾害的频率?
1. 一年一次 2. 五年一次 3. 十年一次 4. 十五年一次 5. 二十年一次

6. 其他,请注明: _____

B2 一般情况下,周边河道是否经常发生淤积阻塞?
1. 是 2. 否

B3 周边河道水土流失,是否会对居民区及周边的生态环境造成不良影响?
1. 是 2. 否

B4 您认为目前周边河道治理现状的评价为: _____
1. 优秀 2. 良好 3. 一般 4. 不良 5. 很差

B5 一般情况下,您日常生活中出行的交通方式是:(请将对应选项号码,填写在以下横线上)
第一位: 9 第二位: 8 第三位: 6
1. 步行 2. 自行车 3. 三轮车 4. 电动车 5. 摩托车 6. 公交车 7. 共享单车
8. 出租车 9. 私家车 10. 地铁 11. 其他,请注明: _____

B6 您日常生活中途经周边河道道路的频率?
1. 每天 2. 每周 3. 每月 4. 其他,请注明: _____

B7 一般情况下,您途经周边河道道路是为了(多选题):
1. 上班/出差 2. 上学 3. 旅游 4. 探亲 5. 就医 6. 娱乐购物
7. 其他,请注明: _____

B8 一般情况下,周边河道附近道路是否存在慢行系统不联通的问题?
1. 是 2. 否

B9 周边河道的现状,是否对您的日常生活带来不便?
1. 是 2. 否

C 城市生态环境影响情况

C1 您关注自己所在地城市的环境情况(如空气质量),并经常主动了解相关信息吗?
1. 经常关注 2. 偶尔关注 3. 从不关注

C2 请选择与您实际相符的选项

项目	非常不满意	比较不满意	一般满意	比较满意	非常满意
1. 您对家庭用水水质的满意程度:					✓
2. 交通工具的速度					✓
3. 您对生态环境(空气质量)满意程度:					✓
4. 您对城市绿化面积是否满意					✓
5. 您对废气排放管控效果的满意程度:					✓
6. 您对城市环境卫生清洁及管理工作满意程度					✓
7. 您对市政府提升生态环境所做的工作及措施是否感到满意					✓
8. 其他问题,请注明: _____					

C3 日常生活中您主要通过哪些方式参与环境治理当中?
1. 了解环保知识 2. 查看环境意见稿公示 3. 参加社会监督,如信访举报
4. 参加环保调查问卷 5. 从身边的小事做起,保护环境 6. 一般不会参与

C4 您的城市出现过以下哪些情况
1. 环境脏乱差 2. 没有人管理 3. 公共设施破坏严重 4. 居民警觉性差
5. 没有良好的治理理念 6. 交通混乱 7. 噪音大 8. 政府处理能力水平低下 9. 其他

C5 您认为城市生态环境建设具有哪些意义?
1. 美化、绿化城市,改善城市生态环境 2. 彰显城市文化的重要手段
3. 提升城市居民生活品质 4. 改善居住环境,保护生物多样性
5. 为居民提供文化活动的场所 6. 对城市气候具有调节作用 7. 有利于推进低碳城市建设

C6 您发现居住城市生态环境建设具有哪些问题?
1. 基础设施不够完善 2. 城市绿化面积不够 3. 城市人文景观比较少
4. 生物多样性比较少 5. 城市水质差,空气污染时有 6. 城市环卫垃圾清理不够及时

C7 您认为当前制约所在城市环境卫生建设的主要问题有哪些
1. 居民环境保护意识薄弱 2. 环境保护教育不深 3. 资金投入不足
4. 管理制度上的缺陷 5. 缺乏专业的环保人员

C8 您对居住城市的绿化环境卫生的满意度打分为?
1. 9-10分 2. 8-9分 3. 7-8分 4. 6-7分 5. 6分以下

C9 您认为公众在城市扩张和生态环境保护中应该扮演何种角色?
1. 积极参与和监督政府决策 2. 改变不良生活习惯,减少对环境的负面影响
3. 推动企业和机构采取环保措施 4. 其他(请注明)

C10 您对城市公园生态环境建设偏重哪些方面?
1. 科学化 2. 注重城市文化元素的传承 3. 以人为本
4. 打造“智慧公园” 5. 强化科普教育

D 防艾卫生宣传与教育

D1 您所在单位/社区重视艾滋病防控工作的开展吗?
1. 非常重视 2. 重视 3. 一般 4. 不重视 5. 非常不重视

D2 您印象中所在单位/社区开展防艾宣传工作宣传次数?
1. 0-2次 2. 3-4次 3. 4次以上

D3 您所在的地区开展过哪些防艾宣传活动(多选)
1. 专题讲座 2. 发放宣传单 3. 观看电影及文艺演出
4. 利用新媒体进行宣传 5. 其他

D4 是否有医务室
1. 有 2. 没有

D5 单位/社区是否定期组织体检
1. 是 2. 否

D6 您对单位/社区关于艾滋病宣传教育的的评价是?
1. 十分满意 2. 满意 3. 一般 4. 差 5. 非常差

E 项目了解、参与、决策和影响情况

E1 您听说过盘州市市政绿色生态及数字化基础设施综合改造项目吗?
 听说过 没有听说过

E2 您对盘州市市政绿色生态及数字化基础设施综合改造项目的了解程度如何?
 1. 很了解 了解 了解一点 不了解

E3 如果听说过,您通过什么渠道听说的?(限选3项)
 报纸、电视、广播和网络 政府海报
 居民/村民委员会 亲戚和朋友
 邻居 其他,请注明: _____

E4 您通常通过什么渠道得到政府宣传信息的?(限选3项)
 宣传册 报纸或电视广播
 网络 社区或街道
 朋友或邻居 没有
 7. 其他,请注明: _____

E5 您是否参加过盘州市市政绿色生态及数字化基础设施综合改造项目相关的公众参与座谈会?
 是 否 不清楚
 E5.1 您参加座谈会的次数: _____

E6 您认为盘州市市政绿色生态及数字化基础设施综合改造项目建设对您家庭重要吗?
 非常重要 重要 一般 不重要 非常重要

E7 您支持盘州市市政绿色生态及数字化基础设施综合改造项目建设吗?
 非常支持 支持 无所谓 反对 非常反对

E8 您是否愿意配合政府实施盘州市市政绿色生态及数字化基础设施综合改造项目?
 非常愿意 愿意 不知道 不愿意 非常不愿意

E9 您认为通过实施盘州市市政绿色生态及数字化基础设施综合改造项目,对完善城市交通运输体系作用是否明显?
 作用明显 作用一般 不明显

E10 您对盘州市市政绿色生态及数字化基础设施综合改造项目是否满意?
 非常满意 一般满意 基本满意 不满意 非常不满意

E11 如果盘州市市政绿色生态及数字化基础设施综合改造项目中,有临时工作机会,您是否愿意参加其中?
 愿意 不愿意 看情况

E12 盘州市市政绿色生态及数字化基础设施综合改造项目是否为女性增加了非农就业机会?
 是 否 不清楚

E12.1 项目办是否优先给予女性就业机会?
 是 否 不清楚

12

E12.2 您对项目办关于女性就业方面的政策满意度如何?
 1. 非常满意 满意 一般 不满意 非常不满意

E13 总体上,您认为本项目的建设给您的家庭和当地带来什么有利影响?(限选3项)
 1. 降低出行的时间
 改善家庭周边的自然环境(包括抑制灰尘,改善景观等)
 3. 促进城市生态修复,可增加旅游业相关收入
 4. 增加工作就业的机会
 5. 完善附近公共基础设施(改善照明环境、路面状况)
 6. 促进当地经济发展,提升当地土地房屋价格
 7. 促进对外开放和当地特色文化传播
 8. 其他,请注明: _____

E14 在本项目的建设和运营过程中,您觉得引起了哪些不利影响?(限选3项)
 1. 施工队周围生态环境的影响,水土流失、水体污染等
 施工期引起短期的出行不便
 3. 施工期间废气、废污水、噪声和振动、固体废物污染
 4. 施工期对本地人的生命财产安全形成不利影响
 5. 施工工人集中生活卫生条件比较差,有可能导致艾滋病、传染病的流行;
 6. 土地征收、房屋拆迁造成的影响
 7. 媒体网络舆论导向及其影响
 8. 不知道
 9. 其他,请注明: _____

E15 该项目在维权方面有无监测、跟踪指导和意见反馈的安排/机制?
 有 没有 不清楚

E16 您对盘州市区域的印象评价是?

项目	非常差	比较差	适中	比较好	非常好
1. 硬件设施					<input checked="" type="checkbox"/>
2. 服务质量					<input checked="" type="checkbox"/>
3. 运输能力					<input checked="" type="checkbox"/>
4. 城市管理					<input checked="" type="checkbox"/>
5. 道路基础设施利用率					<input checked="" type="checkbox"/>
6. 其他问题,请注明: _____					

F 基本信息

F1 您的年龄: 36 岁
 F2 您的性别: 1. 男 女
 F3 您的户口性质: 城镇 农村
 F4 您的文化程度: 1. 文盲 2. 小学 3. 初中 4. 高中/中专 5. 大专及以上

13

Appendix 3: List of Interviewees

Related chapters	Interview records involve specific details of individuals involved
9	Interview Record 9-1: Mr. Song et al. (56 years old) from Jinhe Community, Xingsheng Sub-district
	Interview Record 9-2: Mr. Qi (43 years old) from Tianjia Sub-district, Dawa District
	Interview Record 9-3: Mr. Li et al. (52 years old) from Xingsheng Community, Xingsheng Sub-district
	Interview Record 9-4: Ms. Zhang et al. (48 years old) from Liaohe Sub-district, Shuangtaizi District
	Interview Record 9-5: Ms. Liu et al. (35 years old) from Hongqi Sub-district, Shuangtaizi District
	Interview Record 9-6: Mr. Zhang et al. (43 years old) from Shengli Sub-district, Shuangtaizi District
	Interview Record 9-7: Ms. Zhang (35 years old) from Minzhu Road Street, Xinglongtai District
	Interview Record 9-8: Mr. Zhang (42 years old) from Tiedong Sub-district, Shuangtaizi District
	Interview Record 9-9: Mr. Zhang (35 years old) from Dawa Sub-district, Dawa District
	Interview Record 9-10: Mr. Qi (35 years old) from Tiedong Sub-district, Shuangtaizi
	Interview Record 9-11: Mr. Wang (45 years old) from Xinghai Sub-district, Xinglongtai
	Interview Record 9-12: Ms. Kong (55 years old) from Xinglong Sub-district, Xinglongtai District
	Interview Record 9-13: Mr. Cui (45 years old) from Shuangsheng Sub-district, Shuangtaizi District

Appendix 4: Interview Minutes

time	July 11, 2024
place	Dongsan Community, Dawa Sub-district
Organizational personnel	Dawa District Housing and Urban Rural Development Bureau
Participants	Dawa District Housing and Urban Rural Development Bureau, Dawa Sub-district Secretary and Member, Representative of Dongshan Community Residents, ESIA survey team
Participate in the theme	Special group discussion on the renovation project of drainage network and rainwater and sewage diversion in Dawa District
Main content and results	<p>According to the current situation of the drainage network and the evaluation results of the drainage capacity of the current pipeline pump station, the pipeline network in the area where Dawa District is located is incomplete, and the pipelines on Huashan Road (Shuangqiao Street to Jinyuan Street) and Huashan Road (Jinyuan Street to Hongtan Street) are old. At present, multiple collapses have occurred in this section of the pipeline, which has lost its drainage capacity and urgently needs to be replaced and repaired.</p> <p>2. Residents in the project area expressed that the collapse and lack of rainwater and sewage pipelines have brought a lot of inconvenience to daily travel. The residents in the project area urgently need to eliminate the waterlogging points around the residential area and improve the overall waterlogging prevention and control capabilities of the area.</p> <p>3. The residents have a high level of awareness of the project and are very supportive of its implementation. Residents believe that the project should start construction as soon as possible. Residents along the river expressed that the project can enhance the flood control capacity of the river, improve the safety of bridges, slope protection, and embankment roads along the river.</p> <p>4. Residents also expressed their needs: 1) There is an urgent need for the improvement and renovation of the rainwater and sewage pipeline network in Dawa District. "I hope that the waterlogging points can be cleared as soon as possible. It is very inconvenient to have accumulated water on the road. Not only is it inconvenient to ride bicycles, but sometimes passing vehicles can splash water on the roadside. The improvement and renovation of the rainwater and sewage pipeline is indeed a good thing for the people, and we all support it. In the future, when it rains, it will be much more convenient for us to go out." 2) Some female villagers expressed their hope that the project can bring them job opportunities. "I am currently taking care of my children at home and do not have a job yet. I hope that this project can bring some job opportunities for our housewives. We are willing to participate in the daily management of rivers and roads, such as cleaning work. We are all willing to do it</p>



Appendix 5: List of Social Impact Analysis

Project Name	Affected streets/townships	social results	social risk	
Wetland construction and ecological restoration project	Youyi Sub-district, Xinglongtai District	<p>1) Reconstruct the water system connectivity network in Panjin City and open up urban drainage channels</p> <p>A. By scientifically planning and restoring natural water systems, we can enhance urban drainage capacity and effectively reduce flood disasters.</p> <p>B. Open up urban drainage channels, achieve natural circulation and rational allocation of water resources through measures such as rainwater collection, river lake connection, and wetlands, enhance water regulation functions, and promote ecological balance.</p> <p>2) Eliminate flood prone areas in urban areas and reduce the impact of waterlogging disasters</p> <p>A. By renovating the drainage system, improving low-lying areas, and increasing green spaces, the problem of urban waterlogging can be solved.</p> <p>B. We will strengthen the construction of storage tanks and pumping stations, reduce the accumulation of water in rainstorm, ensure the safety of residents and smooth traffic, and improve the city's ability to cope with climate change and prevent disasters.</p> <p>C. Ensure the safety of people's lives and property in urban areas, guarantee the travel of surrounding residents, and improve the efficiency of residents' travel</p> <p>3) Conduct low impact development to enhance ecological service functions</p> <p>A. Low impact development reduces rainwater runoff and promotes natural water circulation through ecological facilities such as green spaces, wetlands, and permeable pavements.</p> <p>B. Effectively enhance urban ecological service functions, improve air quality, regulate</p>	Construction on stage	<p>1) Land acquisition impact Land acquisition for this component affects Xinglongtai District and Dawa District in Panjin City, occupying a total of 56.25 mu of state-owned land and 0.75 mu of temporary land.</p> <p>2) Negative natural and social environmental impacts generated during construction</p> <p>A. The risk of air pollution, as well as the dust and exhaust emissions caused by the operation of motor vehicles during construction operations such as earthwork excavation and water pipe landfill, and the increase in foreign vehicles.</p> <p>B. Noise pollution risk, mechanical equipment noise generated by excavators and mixers during soil excavation and pipeline laying during the construction period, knocking and cutting noise, truck transportation noise, and noise generated by pump station equipment debugging.</p> <p>C. Water pollution risk. Pollution of surface water, especially drinking water in residential areas, during the construction period.</p> <p>3) The impact of migrant workers</p> <p>A. The risk of influx of foreign workers, increased communication and contact between foreign workers and residents along the project line, can easily lead to security conflicts and problems.</p> <p>B. Health and hygiene risks, to a certain extent, increase the intensity of communication and interaction with local residents, which can easily lead to the spread of certain communicable or epidemic diseases and other health risks.</p> <p>C. The influx of a large number of workers will increase the consumption of resources such as water, electricity, and food, especially during the construction period. The construction of living areas and the disposal of household waste will cause additional pressure on the local environment, leading to a shortage of production and living resources for local residents.</p> <p>D. The risk of cultural differences, where the cultural background of migrant workers differs significantly from the local culture, may lead to cultural conflicts or misunderstandings, resulting in social conflicts. For example, differences in religious beliefs, lifestyle</p>

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Project Name	Affected streets/townships	social results	social risk
		<p>temperature, and enhance urban sustainable development capabilities through water resource management and green infrastructure construction.</p> <p>C. Adopting sponge facilities such as permeable pavement on sidewalks and ecological tree pools to achieve total annual runoff control within the road area and reduce rainwater emissions at the source</p> <p>4) Radiation green production development, promote green lifestyle</p> <p>A. Promote sustainable development in fields such as ecological agriculture and tourism through ecological restoration and green production models.</p> <p>B. Increase green employment opportunities, enhance the environmental awareness of urban residents, promote the popularization of low-carbon lifestyles, and drive the transformation of society towards circular economy and sustainable consumption patterns.</p> <p>5) Satisfy residents' leisure needs and improve their quality of life</p> <p>A. Ecological projects provide more green spaces, wetlands, and parks to meet the leisure and entertainment needs of residents.</p> <p>B. Improving the urban ecological environment, enhancing residents' health and happiness, creating a more livable urban life, promoting community integration and social harmony, and providing high-quality living space for future development</p>	<p>habits, and values may lead to adaptation issues or exclusionary emotions.</p> <p>4) Traffic safety impact</p> <p>A. The impact of road closures and traffic congestion, such as pipeline excavation, river slopes, and the need to close or semi close roads during construction, increases traffic pressure and can easily lead to traffic congestion. Traffic diversion and diversion also increase the possibility of traffic accidents.</p> <p>B. The impact of construction vehicles on road safety. During the construction process, a large number of trucks, excavators, and construction vehicles frequently enter and exit the construction area. These vehicles are large in size and slow in speed, which may cause inconvenience or even traffic accidents. These vehicles may temporarily occupy road space during loading and unloading, increasing the danger of the road.</p> <p>C. Road surface damage and safety risks, frequent crushing of roads by large construction vehicles during the project may result in road surface damage and increased potholes; During the excavation of pipelines or the construction of river slope protection, temporary roads or bridges are often used for vehicles and pedestrians to pass through. The quality and safety of these temporary facilities may not be as good as formal roads, leading to risks of accidents such as collapse and overturning.</p> <p>5) Risk of unfinished construction during flood season</p> <p>A. Increased economic losses: Due to construction interruptions or delays, repair costs and additional engineering costs will increase, and the construction party and related stakeholders may face enormous economic pressure.</p> <p>B. The incomplete completion of critical infrastructure will affect residents' daily lives, transportation, and urban functions, leading to a decrease in residents' satisfaction and potentially triggering social conflicts and complaints.</p> <p>C. The impact of slippery roads on rainy days requires extensive earthwork operations for pipeline excavation, slope protection construction, or wetland construction. On rainy days, soil is easily washed onto the road, causing it to become slippery and increasing</p>

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Project Name	Affected streets/townships	social results	social risk	
				<p>the risk of vehicle slippage and loss of control, especially for two wheeled vehicles such as electric vehicles.</p> <p>6) Gender influence in society Gender inequality may occur during the construction process and daily affairs on the construction site, including discrimination against women in terms of working hours, resulting in physical, mental, or sexual harm to women, including gender based violence such as threats, coercion, or arbitrary deprivation of freedom.</p>
			Operation stag	<p>1) Potential social risks during project operation A. Employment imbalance and project operation may lead to changes in the labor market within the region. Some positions may require specialized skills, which local labor may not be able to meet, leading to skill mismatches and unequal employment opportunities. B. Conflict in resource allocation: Projects may generate significant demand for local water resources, land, energy, and other resources, which may affect the supply of resources to local residents or other businesses, potentially leading to conflicts, especially in situations of resource scarcity or uneven distribution. C. Air and noise pollution, if significant air or noise pollution is generated during project operation, may affect the health and quality of life of surrounding residents. For example, the operation of industrial projects, transportation projects, or large-scale infrastructure may result in sustained noise or exhaust emissions, affecting the daily lives of residents.</p> <p>2) Traffic safety risks A. After wetlands or ecological areas attract tourists, the influx of tourist vehicles may have an impact on the transportation of local residents, especially when road capacity is insufficient. B. After wetland construction and ecological restoration, it may attract frequent visits from tourists, researchers, etc., leading to an increase in local traffic flow, especially at the entrance of scenic spots, parking lots, and surrounding roads.</p> <p>3) Labor management risk A. Social security risks, the influx of a large number of migrants may bring security risks, especially in the case of insufficient social management resources, which may increase crime rates or social</p>

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Project Name	Affected streets/townships	social results	social risk	
				<p>security issues.</p> <p>B. During the operation period, it may involve wetland maintenance, equipment inspection, water resource management, and other work, which may pose occupational health and safety hazards due to exposure to natural environments (such as wetland moisture, mosquito bites) or operation of mechanical equipment.</p> <p>C. The operation of wetland and ecological restoration projects requires professional skills (such as ecological monitoring, environmental management, wetland maintenance), and if labor lacks relevant training or experience, it may be difficult to meet the job requirements.</p> <p>4) Risk of insufficient participation of vulnerable groups</p> <p>A. The risk of uneven distribution of project benefits, where vulnerable groups may struggle to participate fairly in the sharing of project benefits due to insufficient resources, information, or capabilities, such as employment opportunities and economic benefits brought by wetland tourism development, ecological industries, etc.</p> <p>B. The risk of uneven utilization of social resource services, wetland projects may focus on improving certain social services (such as education, healthcare, transportation, etc.), but vulnerable groups may not be able to enjoy these resources fairly due to geographical location, economic conditions, and other limitations.</p>
Improvement and renovation project of drainage facilities	Xinghai Sub-district and Zhenxing Sub-district in Xinglongtai District	<p>1) Improve drainage facilities and solve pipeline congestion</p> <p>A. Update and replace the old water pipes with new specifications to increase the drainage capacity of the rainwater system</p> <p>B. Increase the capacity of the pipeline network by expanding and repairing existing drainage pipelines, improving the capacity and efficiency of the drainage system, and reducing congestion.</p> <p>C. Introduce intelligent management, use sensors to monitor water level and flow, timely clear pipelines, and improve drainage efficiency and safety.</p> <p>D. Upgrade old pump station facilities, enhance the capacity of key drainage nodes, and ensure</p>	Construction stage	<p>1) Land acquisition impact</p> <p>The land acquisition of this subcomponent affects Shuangtaizi District, Xinglongtai District, and Dawa District in Panjin City, involving collective land acquisition of 28.5 mu, occupation of 138.04 mu of state-owned land, temporary occupation of 655.35 mu, and house demolition of 16,134 square meters. A total of 83 households and 244 people are affected. Among them, 50 households with 153 people are affected by permanent LA, 9 households with 35 people by state-owned farm land occupation, 2 households with 5 people by temporary occupation of collective land, and 72 households with 204 people by HD.</p> <p>2) Negative natural and social environmental impacts generated during construction</p> <p>A. The risk of air pollution, as well as the dust and exhaust emissions caused by the operation of motor vehicles during</p>

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Project Name	Affected streets/townships	social results	social risk
		<p>rapid drainage even during heavy rain.</p> <p>2) Eliminate waterlogging prone areas and reduce flood disasters</p> <p>A. Add drainage facilities such as pump stations and storage tanks in low-lying areas to ensure rapid drainage of rainwater.</p> <p>B. Optimize urban terrain, improve urban drainage layout, utilize permeable materials and green spaces to reduce surface runoff.</p> <p>C. Improve rainwater collection by reducing drainage pressure and minimizing the possibility of water accumulation through rainwater collection systems.</p> <p>3) Reduce the frequency of sewage overflow and solve the problem of overflow pollution</p> <p>A. Enhance the capacity of the pipeline network by upgrading the drainage network to prevent sewage from overflowing into rivers during heavy rain and reduce water pollution.</p> <p>B. Construct sewage storage tanks, increase storage facilities, store overflow sewage, and avoid direct discharge of untreated sewage.</p> <p>C. Improvement of interception facilities, adding interception devices to ensure that sewage is directed to treatment facilities rather than directly discharged.</p> <p>4) Diverting sewage and rainwater to improve urban water environment</p> <p>A. Implement a diversion system for drainage, separate sewage and rainwater for discharge, avoid mixed pollution, and reduce the phenomenon of sewage overflow.</p> <p>B. Construct a new diversion pipeline network and renovate the drainage system in old urban areas to achieve independent treatment of sewage and rainwater.</p>	<p>construction operations such as earthwork excavation and water pipe landfill, and the increase in foreign vehicles.</p> <p>B. Noise pollution risk, mechanical equipment noise generated by excavators and mixers during soil excavation and pipeline laying during the construction period, knocking and cutting noise, truck transportation noise, and noise generated by pump station equipment debugging.</p> <p>C. Water pollution risk. Pollution of surface water, especially drinking water in residential areas, during the construction period.</p> <p>3) The impact of migrant workers</p> <p>A. The risk of influx of foreign workers, increased communication and contact between foreign workers and residents along the project line, can easily lead to security conflicts and problems.</p> <p>B. Health and hygiene risks, to a certain extent, increase the intensity of communication and interaction with local residents, which can easily lead to the spread of certain communicable or epidemic diseases and other health risks.</p> <p>C. The influx of a large number of workers will increase the consumption of resources such as water, electricity, and food, especially during the construction period. The construction of living areas and the disposal of household waste will cause additional pressure on the local environment, leading to a shortage of production and living resources for local residents.</p> <p>D. The risk of cultural differences, where the cultural background of migrant workers differs significantly from the local culture, may lead to cultural conflicts or misunderstandings, resulting in social conflicts. For example, differences in religious beliefs, lifestyle habits, and values may lead to adaptation issues or exclusionary emotions.</p> <p>4) Traffic safety impact</p> <p>A. The impact of road closures and traffic congestion, such as pipeline excavation, river slopes, and the construction of new pumping stations, requires the closure or semi closure of roads, which increases traffic pressure and easily leads to traffic congestion. Traffic diversion and diversion also increase the possibility of traffic accidents.</p>

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Project Name	Affected streets/townships	social results	social risk
		<p>C. Reduce rainwater runoff pressure, reduce the burden on the drainage system through diversion system, improve drainage efficiency, and enhance the water environment.</p> <p>5) Update old equipment and improve operational services</p> <p>A. Upgrade the drainage network, replace aging pipelines, improve drainage efficiency, and reduce pipeline failures and blockages.</p> <p>B. Intelligent pump station management, introduction of automatic control system, improves the operational efficiency of the pump station and reduces manual intervention.</p> <p>c. Adopting advanced treatment technologies, updating sewage treatment plant equipment, improving sewage treatment capacity and water quality, and reducing pollution.</p> <p>6) Realize source emission reduction and build sponge cities</p> <p>A. Increase green spaces and wetlands, absorb rainwater through natural facilities, reduce rainwater runoff, and enhance ecological regulation functions.</p> <p>B. Permeable pavement application, laying permeable materials in cities to reduce rainwater retention and lower drainage pressure.</p> <p>C. Rainwater garden construction, through ecological design such as rainwater gardens, stores and purifies rainwater to achieve natural circulation.</p>	<p>B. The impact of construction vehicles on road safety. During the construction process, a large number of trucks, excavators, and construction vehicles frequently enter and exit the construction area. These vehicles are large in size and slow in speed, which may cause inconvenience or even traffic accidents. These vehicles may temporarily occupy road space during loading and unloading, increasing the danger of the road.</p> <p>C. Road surface damage and safety risks, frequent crushing of roads by large construction vehicles during the project may result in road surface damage and increased potholes; During the excavation of pipelines or the construction of river slope protection, temporary roads or bridges are often used for vehicles and pedestrians to pass through. The quality and safety of these temporary facilities may not be as good as formal roads, leading to risks of accidents such as collapse and overturning.</p> <p>5) Safety risks of unfinished construction during flood season</p> <p>A. The intensification of floods and waterlogging disasters makes it difficult for unfinished infrastructure such as drainage networks and pumping stations to effectively cope with rainfall during the flood season, which can easily lead to urban waterlogging, increase the risk of flood impact, and affect residents' safety and property.</p> <p>B. Construction safety hazards, such as heavy rainfall during the flood season, may cause water accumulation, soil collapse, and damage to machinery and equipment on the construction site, threatening the safety of workers, delaying the construction period, and even causing accidents.</p> <p>C. Temporary poor drainage may affect the construction of pipelines and drainage systems. During this period, temporary drainage facilities may not be able to cope with sudden heavy rain, resulting in road surface water or even flooding. This not only affects traffic flow, but also leads to problems such as vehicle loss of control or engine water ingress.</p> <p>6) Gender influence in society</p> <p>Gender inequality may occur during the construction process and daily affairs on the construction site, including discrimination against women in terms of working hours, resulting in physical,</p>

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Project Name	Affected streets/townships	social results	social risk	
				<p>mental, or sexual harm to women, including gender based violence such as threats, coercion, or arbitrary deprivation of freedom.</p> <p>Operation stage</p> <p>1) Other social risks during the project operation period</p> <p>A. Community health and safety risks, if facilities malfunction due to improper maintenance or poor operation, may lead to sewage overflow or water accumulation, causing health risks such as water source pollution and the spread of infectious diseases.</p> <p>B. Under extreme weather conditions, facilities may not be able to cope with floods, affecting the safe travel and living environment of the community.</p> <p>C. The service coverage is uneven, and the renovated drainage facilities may have differences in regional coverage, and some communities may not have received sufficient services.</p> <p>D. If the drainage facilities fail to achieve the expected effect of the public during operation, it may lead to social dissatisfaction, complaints, and protests.</p> <p>2) Traffic safety risks</p> <p>A. Equipment maintenance or repair occupies roads, and drainage facilities require regular maintenance, which may temporarily occupy road space, causing traffic congestion or affecting pedestrian and vehicle traffic.</p> <p>B. Traffic accidents caused by slippery road surfaces may increase the risk of traffic accidents during rainy days or during facility drainage processes.</p> <p>C. Vehicle traffic restrictions and insufficient road signage pose risks, which can easily lead to traffic chaos or accidents.</p> <p>3) Labor management risk</p> <p>A. Operational environmental risks: During the operation of drainage facilities, workers may come into contact with sewage, toxic gases (such as hydrogen sulfide), and slippery working environments, increasing the likelihood of occupational diseases and work-related injuries.</p> <p>B. There is a shortage of skilled labor, and the operation of facilities has high requirements for skilled workers. If the personnel turnover rate is high, it may affect the normal operation and management of facilities.</p>

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Project Name	Affected streets/townships	social results	social risk
			<p>C. Difficulty in managing temporary workers, temporary workers may be needed during peak maintenance periods, and management negligence may lead to safety accidents or conflicts.</p> <p>D. Insufficient emergency management capabilities, when facilities malfunction or natural disasters occur, workers may face personal safety threats, and the lack of emergency plans will exacerbate risks.</p> <p>4) Risk of insufficient participation of vulnerable groups</p> <p>A. Vulnerable groups are highly affected, and in the maintenance or operation of drainage facilities, some vulnerable groups may be unable to provide timely feedback or seek help due to economic constraints or lack of information channels.</p> <p>B. In important decision-making and emergency response during facility operation, public opinions may be overlooked, affecting the community's sense of identification and support for the project.</p>

Appendix 6: Labor Code of Conduct

Article 1: In order to standardize labor safety behavior, enhance labor safety awareness, and strengthen labor prevention capabilities, this regulation is specially formulated.

Article 2: This standard applies to all personnel on the construction site.

Article 3: Adhere to Principles

Six Strict Safety Management Operations for the “Four Alls”

1. Strictly implement the shift handover system
2. Strictly conduct patrol inspections
3. Strictly control the process indicators.
4. Strictly follow the operating procedures.
5. Strictly abide by labor discipline.
6. Strictly implement safety regulations

Article 4 Safety Regulations for Construction Personnel

(1) Not wearing labor protection equipment is strictly prohibited from entering the production or construction site;

(2) Barefoot, slippers, sandals, and high heels are strictly prohibited from entering the work site;

(3) Prohibit drinkers from entering production and construction areas;

(4) It is strictly prohibited to bring children or strangers into the production area;

(5) Workers must abide by labor discipline and obey the commands of leaders and safety management personnel; Do not take other people's belongings, protect your own wealth

(6) It is strictly prohibited to sleep, leave, wander around, or engage in activities unrelated to production during working hours;

(7) It is strictly prohibited to bring ignition and flammable, explosive, toxic, or corrosive materials into the premises; It is strictly prohibited to use open flames at the construction site;

(8) It is strictly prohibited to sit, lie, run, or jump on operating equipment, racks, walkways, or railings, and it is strictly prohibited to cross walkways or railings;

(9) It is strictly prohibited to play, frolic, fight or brawl at the homework site;

(10) Take the elevator to ensure safety, prevent falls, and prevent falling objects;

(11) Workers must comply with various safety warning signs, labels, and warning instructions

(12) Damage caused by personal factors; All consequences shall be borne by the parties involved

Article 5 Protection and Safety

(1) Before starting work, it is necessary to wear various types of labor protection equipment according to the requirements of the work;

(2) Work clothes must be fastened, with tight cuffs, pant legs, and placket;

(3) Female workers should tidy up their long hair and put it inside their safety helmets;

(4) Safety helmets must be fastened; It is strictly prohibited to sit or press safety helmets;

Article 6 Operation Safety

(1) Job workers must strictly implement the job handover system

(2) Job workers must conscientiously implement job operation laws, fulfill job safety responsibilities, and control various parameters within the range of indicators

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- (3) Non electrical personnel are strictly prohibited from tampering with electrical equipment at will
- (4) Electrical equipment must be kept dry and ventilated, and wet hands are strictly prohibited from touching switches and electrical equipment; It is strictly prohibited to clean electrical facilities with water;
- (5) In case of fire in electrical equipment, it is forbidden to use water and foam to extinguish the fire without cutting off the power supply;
- (6) It is strictly prohibited to connect or pull power sources without authorization, and install various electrical equipment privately;
- (7) It is strictly prohibited to connect temporary power sources without cutting off the power supply;
- (8) It is strictly prohibited to use iron wire or copper wire as fuses; Isolation switches and fall protection devices are strictly prohibited from operating under load;
- (9) It is strictly prohibited to operate electrical switches with warning signs at will; It is strictly prohibited to remove warning signs on electrical switches at will; (10) The team leader must conduct a safety briefing to the team members before starting the operation;

Article 7 Accommodation Safety

- (1) Please respect the restrictions and instructions of the accommodation area. Do not enter or stay in unauthorized areas.
- (2) Please respect the designated curfew hours and avoid going out at night. This helps ensure the tranquility and safety of the nighttime accommodation area.
- (3) If unauthorized personnel are noticed within the accommodation area, immediately report to security or management personnel.
- 4) Comply with all accommodation rules and safety procedures of the construction site.

Appendix 7: Terms of Reference for External Environmental Monitoring (Indicative)

This document outlines the task outline of the external environmental monitoring agency to ensure that the implementation of the project complies with the laws and regulations of the People's Republic of China (PRC) and the Environmental and Social Policy (ESP) of the Asian Infrastructure Investment Bank (AIIB). The direct client is the project implementation unit, Panjin Municipal Construction Group Co., Ltd. (PMCG). According to the environmental and social policies of the Asian Infrastructure Investment Bank, due to the wide impact of this project and the large amount of land acquisition and demolition involved, it is classified as an Environmental and Social Category A project and requires the preparation of an Environmental and Social Impact Assessment (ESIA) and an Environmental and Social Management Plan (ESMP). The environmental and social management plan requires the hiring of a qualified local environmental monitoring agency (EMA) to conduct external environmental monitoring.

Implementation arrangements. External environmental monitoring will be undertaken by the EMA hired by the project implementation unit. The monitoring funds will be provided by AIIB loans, and recruitment must comply with AIIB procurement policies. EMA will work closely with the environmental specialist of the project office, Panjin Municipal Group, Panjin Ecological Environment Bureau, as well as contractors, consultants, communities, and/or other personnel as needed.

The project office and Panjin Municipal Group will provide assistance to EMA in field investigations, personnel allocation, and logistical support. Specifically, (i) paper and electronic versions of environmental and social management plans, domestic environmental impact assessments, domestic feasibility study reports, loan and project agreements, maps, and other supporting materials will be provided to EMA as needed; (ii) Coordinate communication between EMA and major project organizations (including contractors and construction supervision companies); (iii) Carry out comprehensive coordination work, including reviewing external environmental monitoring reports; (iv) Ultimately responsible for submitting external environmental monitoring reports to the AIIB.

Reporting requirements. The EMA will submit external environmental monitoring reports to AIIB and Panjin Municipal Group every six months during the construction and operation periods.

The external environmental monitoring report will include but not limited to: (i) a description and results of the activities carried out during the reporting period; (ii) All cumulative data collected up to the current reporting period; (iii) Any situation that does not meet the target standards; (iv) Any other observational results (qualitative or quantitative); (v) Lessons learned; And (f) the work plan for the next monitoring period.

The comprehensive external environmental monitoring report will summarize the results, conclusions, lessons learned, and recommendations of the overall monitoring plan. All raw data will be handed over to Panjin Municipal Group in a clear and simple format.

EMA will take full responsibility for the content and quality of the report.

Service scope. The EMA should (i) have relevant domestic certifications required for conducting environmental monitoring; (ii) Ensure the provision of all certification equipment and other resources required for monitoring, analysis, and reporting, including on-site sampling and laboratory equipment, as well as logistical resources (vehicles, etc.); (iii) Assign qualified and experienced staff to directly participate in on-site visits, monitoring, analysis, and reporting activities, who should (a) hold a degree in environmental management or related fields (master's degree or above); (b) Ability to effectively communicate and collaborate with local communities, contractors, and government agencies; (c) Experience in data collection, analysis, and report writing; (d) Healthy and physically fit, able to visit remote project construction sites in different seasons.

The EMA will perform the following tasks.

- 1 Review the projects listed in the environmental and social management plan, as well as the environmental and social impact assessment report; (b) Meet with the project organization; Conduct on-site visits with (c) to familiarize oneself with the project site and monitoring requirements.

- 2 Recommend additional monitoring variables and/or monitoring methods (such as monitoring location or frequency) as needed for projects listed as "external monitoring" in the environmental and social monitoring plan table of the environmental and social

management plan, and provide clear reasons for any proposed changes. Attention: Without the approval of Panjin Municipal Group and AIIB, no changes may be made to the monitoring plan.

3 Design an implementation plan for environmental monitoring, including clear methods and work schedules.

4 Data recording and archiving management. (For example, Excel spreadsheets). Data should be entered and stored in a clear and simple format for comparison of values at different times; And ensure that the data is backed up on at least one external storage device.

5 Implement monitoring plan.

6 If any non-compliance with monitoring standards and/or other environmental management issues are observed at the monitoring site, immediately report to Panjin Municipal Group.

7 Identify any situations that exceed project standards and their reasons.

8 Prepare and submit external environmental monitoring reports.

9 Work closely with Panjin Municipal Group, contractors, construction supervision companies, consultants, communities, and other stakeholders.

Three domestic specialists will provide consulting services for environmental monitoring. The main responsibilities are as follows (but not limited to):

Environmental specialist/team leader (domestic). Specialists will undertake the following tasks: (i) leading all activities of the team; (ii) Lead and develop monitoring methods, including designing baselines and tracking surveys; (iii) Collaborate and coordinate with relevant institutions and/or groups within the project to implement monitoring activities and tasks; (iv) Lead and carry out monitoring activities and necessary investigations, collect data and information from desk research and project sites, and analyze investigation results; (v) Write an external environmental monitoring report that includes conclusions and recommendations; (vi) Discuss the investigation results with Panjin Municipal Group. Specifically, specialists will:

1 Coordinate overall monitoring activities according to contract requirements;

2 Develop detailed work plans and procedures;

3 Regularly visit the site and guide local on-site staff;

4 Regularly hold meetings to review work progress and propose improvement actions;

5 Review and monitor the work plan;

6 Review and finalize monitoring reports;

7 Provide suggestions based on the progress and participate in the handling of pollution accidents;

8 Review the environmental aspects of the construction management plan and assess the compliance of the environmental protection system established by the contractor.

Field surveyors (domestic, 2). The investigator will (i) assist the team leader in conducting external environmental monitoring to ensure that environmental management complies with the environmental and social management plan; (ii) Conduct on-site investigations under the guidance of environmental specialists; (iii) Analyze the data collected from on-site investigations; (iv) Assist environmental specialists in preparing external environmental monitoring reports; (v) Perform any other tasks assigned by environmental specialists/team leaders. Specifically, the investigator will

1 Conduct on-site investigations and inspections under the guidance of environmental specialists;

2 Participate in the development of environmental monitoring implementation plans;

3 Conduct environmental monitoring at the project site to assess compliance with relevant

environmental standards and regulations;

- 4 Identify problems, report them promptly, and propose mitigation measures;
- 5 Arrange on-site meetings, coordinate effectively with clients and contractors, and provide training as needed;
- 6 Participate in handling pollution accidents under the guidance of environmental specialists;
- 7 Prepare an external environmental monitoring report;
- 8 Undertake other tasks assigned by environmental specialists.