SFG3231 REV

World Bank Financed
Liaoning Safe and Sustainable Water Supply Project

(No.: P158713)

ENVIRONMENTAL MANAGEMENT PLAN

Prepared by
Liaoning Urban Construction & Renewal Project Office
Shenyang Water Group Co., LTD
Anshan Water Supply Company
Fushun Water Supply Company
Fuxin Water Supply Company
Gaizhou Water Supply Company

May 2017

CURRENCY EQUIVALENTS

(Exchange Rate Effective November 30, 2016)

Currency Unit = RMB

RMB 6.68 = US$1

FISCAL YEAR

January 1 - December 31

ABBREVIATIONS AND ACRONYMS

CLG	City Leading Group
CPS	Country Partnership Strategy
EA	Environmental Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
FSR	Feasibility Study Report
GDP	Gross Domestic Product
FIRR	Financial Internal Rate of Return
FYP	Five Year Plan
GDP	Gross Domestic Product
GIS	Geographic Information System
IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
LDRC	Liaoning Provincial Development and Reform Commission
LEPB	Liaoning Provincial Environmental Protection Bureau
LIBOR	London inter-bank offered rate
LPCD	Liaoning Provincial Construction Department
LPFB	Liaoning Provincial Finance Bureau
LPLG	Liaoning Provincial Leading Group
LUCRPO	Liaoning Urban Construction & Renewal Project Office
NCB	National Competitive Bidding

NDRC	National Development and Reform Commission
NRW	Non-Revenue Water
PAD	Project Appraisal Document
PCG	Project City Government
PDO	Project Development Objective
PIU	Project Implementation Unit
PMO	Project Management Office
PPP	Private Public Partnership
QBS	Quality Based Consultant Selection
QCBS	Quality and Cost Based Consultant Selection
RAP	Resettlement Action Plan
RFP	Resettlement Framework Policy
SAR	Social Assessment Report
SCADA	Supervisory Control and Data Acquisition
WSP	Water Supply Plant

Table of Contents

I. Introduction

1. This Environment Management Plan (EMP) was prepared for the Liaoning Safe and Sustainable Water Supply Project (the Project) in Liaoning Province, the People's Republic of China (PRC). The EMP has been prepared in accordance with requirements of the World Bank Safeguard Policy on the basis of (i) the five domestic environmental assessment (EA) reports provided by the local EA Institutes, (ii) the five project Feasibility Study Reports (FSRs), (iii) the social and economic assessments conducted under the Project Preparatory, and (iv) discussions between the World Bank missions, Liaoning Urban Construction & Renewal Project Office (LUCRPO), Liaoning Provincial Development and Reform Commission (LDRC), Liaoning Provincial Finance Department (LFD), as well as the five project cities' governments and five water supply companies in the cities of Shenyang, Anshan, Fushun, Fuxin and Gaizhou.

2. According to environmental screening and classification requires in World Bank Safeguard Policy Environment Assessment (OP4.01), the proposed project is classified to Class B project based on the type, location, sensitivities, scales, and potential environmental impacts of the project.

3. The proposed Project Development Objectives (PDOs) are to improve access to safe and quality water supply services, and strengthen the operational efficiency of water supply companies in the five project cities in Liaoning Province. This objective will be achieved through investment in the construction, rehabilitation and upgrading of the water supply infrastructure facilities and the improvement of the water supply companies' operational and management capacity.

II. Project Description

II-1 Components of Project

4. The project consists of four components: Component 1 - Water Supply Infrastructure Improvement; Component 2 - Water Supply Service Management Improvement; Component 3 - Institutional Strengthening and Capacity Building; and Component 4 - Project Implementation Support. Each component includes subprojects. The contents of components are shown in Table II-1 below.

Table II-1 Project Components

Component	Description
Component 1. Water Supply Infrastructure Improvement	The component will focus on civil works construction that will directly increase the quantity of water supply and improve the distribution network capacity and performance. Activities to be taken under the component include (i) rehabilitation of the two existing WSPs in the cities of Anshan and Fuxxin, respectively; (ii) upgrade, rehabilitation and replacement of water supply distribution networks, including main trunks (with the length of more than 200 km) and several hundred kilometers of secondary water distribution pipelines; and (iii) upgrade, rehabilitation and replacement of booster pumps, aiming at improving their performance and reducing secondary contamination.
Component 2. Water	This component will focus on enhancing the water supply service

Supply Service Management Improvement	management through non-revenue water (NRW) reduction, water quality monitoring, energy savings, and effective asset management. Activities to be taken under this component include (i) mapping and modeling of all water distribution systems in the five cities, using GIS; (ii) development of comprehensive NRW reduction programs, covering the reduction of technical and commercial losses, including the development of on-line monitoring and analysis systems for pipeline operation and leakage control, the purchase of leak detection equipment and related monitoring and measuring instruments, preparation and implementation of the NRW reduction plans; (iii) development and upgrade of water supply service computerized intelligent water supply management systems, including SCADA and MIS; and (iv) enhancement of water quality monitoring schemes.
Component 3. Institutional Strengthening and Capacity Building	This component will provide consultancy services to build and strengthen the institutional capacities of water supply companies in the cities with emphasis on the utility reform in terms of its organizational arrangement to cope with achieving the project objectives. Activities to be financed under the component would cover training and capacity building of utility staff, particularly on (i) project management, (ii) water quality monitoring, (iii) intelligent water supply management systems, (iv) operation and management of WSPs and secondary pump stations, and (v) leakage detection and NRW management.
Component 4. Project Implementation Support	This component would provide trainings and consultancy services for effective and efficient implementation of the project. Activities under the component include on (i) office equipment; (ii) domestic and international training; (iii) project management consultants for design and construction supervision; and (iv) external monitoring of implementation of environmental and social safeguards.

II-2 Subprojects of Each Project City and Current Status of Construction Sites

5. The construction of the Project mainly include: i) renovation the current WSP in Anshan, Fuxin and Gaizhou; ii) reconstruction of secondary boosting pumping stations and Anshan Tangshan water source pump station; iii) construct and reconstruct municipal water supply pipe and valves; iv) reconstruction of pipes within the old residential communities. The project involves temporary occupation land except for the permanent land for new pump station works in Fuxin. Of which: i) construction works of water source pump, WSP and secondary boosting pumping station will be conducted within the current sites of water supply companies; ii) the reconstruction of municipal water supply pipes will temporarily occupy the current municipal roads (non-motorized lane); iii) reconstruction of pipes within the old residential communities will be conducted under the community roads, part of the pipes will pass through community greenbelt, the road and grassland will be recovered after the pipes are constructed.

6. Sensitive areas: pipe works involves the Nanguan Catholic Church in Shenyang project. Other projects do not involve any cultural relics, religious venue, protected areas, ethnic minority community and other sensitive areas.

Table II-2 Description of Project Activities

City	Description of Project Activities	Environmental status and sensitive areas in construction sites[1]
Shenyang	● Upgrading 12.07 km water supply pipe (DN300 ~ DN1200mm); ● Newly construct 4.42 km water supply pipe (DN1000mm); ● Installation of 34 flow meters; and ● Upgrading and newly installation of 42 valves. ● Pipe network zoning rehabilitation project include reconstruction water supply pipe network of 60.185 km (DN150～DN1000mm); newly construct pipe network of 49.310 km (DN300～DN1000mm); reconstruction and newly installation of 107 valves; ● Secondary water supply system rehabilitation subproject includes: reconstruction of the old secondary water supply system with total length of 109.27 km (DN25 ~ DN300 mm), reconstruction of 99 old secondary water supply pump stations; ● Procurement of 10 sets of water quality testing equipment, 48 sets of pipeline leak detection equipment and 33 sets of pipeline repair equipment ● Construction of intelligent water supply operation platform, including: i)construct an improved pipe GIS; ii) construct and improve the online monitoring system for WSP and water source pump stations; iii) construct remote online monitoring system for secondary boosting pump station; d) regional water supply pipeline network analysis platform.	● The total length of municipal pipe works under the project is 130.82 km, including 49.05 km of newly construction, 81.77 km of reconstruction, it will temporarily occupy the current municipal roads of 0.65 km^2. The pipes will be laid under the current roads (most of which are non-motorized lanes); ● Courtyard pipe works are under the community roads, part of the pipes will pass through community greenbelt, the road and grassland will be recovered after the pipes are constructed； ● The pipe work site is more than 200 m from Nanguan Catholic Church, the nearest distance between the construction site to the protection boundary (30m out of the Church wall) is about 180m. The construction will not occupy (including temporary occupying) any area within the protection range. The impact of noise and dust is little. However, since the construction site will take the way of entrance and exit of the church, traffic safety and congestion will be the main impact. During the public consultation, the church has suggested the construction date would better avoid Easter, Pentecost Day, Dormition and other Catholic feast days (April 1st, May 22nd and August 15st). The EA institute has forwarded the information to Shenyang Water Group and DI to determine the construction duration to be September to October, 2018, to minimize the impact to the church.
Anshan	● Reconstruction of 375,000 m^3/d water source pumping station (the electrical	● the reconstruction for Tanghe River water source pump station, Wangjiayu WSP, intelligent water

[1] Land usage status and surrounding sensitive areas in construction sites (including affected residential spots/villages, cultural relics, religious venue, protected areas).

	system); ● Renovation of Wangjiayu WSP: including new system of 150,000 m3/d produced since 2010 and old system of 200,000 m3/d produced since 1993, the renovation include comprehensive pump room, backwash wastewater recycling and disinfection system; ● Reconstruction of 40 km old pipeline including pipes, valves and pipe leakage detection devices; ● Reconstruction of 80 secondary boosting pumping stations; ● Courtyard pipe renovation for secondary water supply pump station; ● Reconstruction of pipes and courtyard pipe network within the old residential communities, including Development Zone, Qianshan, Lishan and Tiedong residential areas. ● Construction of intelligent water supply operation platform, including: i)construct information system, includingprimary data center, information safety, information planning, water quality testing center management system; ii) construction of water quality online metering; iii) construction of three-level measurement system; iv) automatic-control improvement construction of secondary pump stations; v) water metering reconstruction (water metering reconstruction for non-estate management residential area, resident users and large consumers; vi) office equipment and engineering vehicle procurement .	construction and secondary water supply boosting pump station are to be conducted within the current site and not involve land acquisition and temporary land occupation; ● the length of old municipal water supply pipe reconstruction is 39.545 km, it will temporarily occupy 0.079km2 of the current urban roads (non-motorized vehicle); ● The length of courtyard pipe renovation is 94.428 km, it will temporarily occupy 0.079km2 of the current roads in the residential community, the project doesn't involve community green land; ● The pipe works in Chuangye Road will pass through one railway, the outlet conduct of Dagushan Pump Station will pass through one location in Wanshuihe River, which is with water quality protection of IV level. The construction will adopt non-execution technologies as stay tube and pipe jacking to minimize the impact to the surrounding environment.
Fushun	● Construct 57.732 km municipal distribution pipeline (DN 20-900mm) ● Construct 652.947 water supply pipeline within residential communities; and ● Upgrading 70 water supply boosting pumping stations, including renovation of water supply facilities in pump station; automatic system and unmanned surveillance equipment, security and protection system, and construction of central control platform to realize the unmanned real-time monitoring;	● The pipe works in Fushun is with the total length of 710.679 km, the temporary occupation land is of 1.77 km2 on urban non-motorized lanes. ● The reconstruction works of 70 pump stations will be conducted in the original sites including facility updating, no additional land will be acquired; ● Courtyard pipe works within the residential communities will be

	● Construction of intelligent water utility, including i) intelligent water utility operation platform; ii) source water quality detection and warning platform; iii) automatic construction works for WSP; iv) intelligent metering management platform and leakage platform; v) intelligent control platform for production scheduling system	conducted under the community roads, part of the pipes will pass through community greenbelt, the road and grassland will be recovered after the pipes are constructed ● Works in Fushun do not involve any cultural relics, religious venue, protected areas, ethnic minority community and other sensitive areas.
Fuxin	● Reconstruct and construct 49.35 km of pipes with the diameters of DN100-DN1200, of which, the new water supply pipe of 29.51 km, reconstructed pipe of 19.84 km; ● Construction of two boosting pumping stations with the capacities of 15,000 m3/d and 10,000 m3/d, respectively; ● Reconstruction of 57.683 km secondary water supply pipes within the old residential communities, reconstruct water supply pipes for 40387 households; ● Water quality monitoring equipment and intelligent water utility infrastructure construction works, including: i) drinking water detection index increased from the original 45 items to 90 items, procure water quality laboratory examination equipment; ii) add operation monitoring, information transmission, remote control system for the existing 162 pump stations; iii) upgrading process equipment for the 9 pumping stations; iv) install 50 pressure data terminals in the urban area; v) implement 30 urban water quality online monitoring spots; vi) construction of GIS for water supply network ● WSP reconstruction project: upgrade heating, ventilation, walls, roof, automatic control system and part of equipment for reaction sedimentation workshop, dosing room, filter workshop, chlorine room and high and low voltage distribution room in Naodehai WSP.	● In Fuxin, the construction and reconstruction length of pipe is 49.35 km, the reconstruction length of community secondary water supply pipe is 57.683 km, the temporary occupation land is of 0.163 km2 on urban non-motorized lanes ● The permanent land of the pump station project covers an area of 6.048 mu, of which, the state-owned land transfer with compensation of 3.024 mu, the land owns by the Development Zone Government; the project also acquired construction land of 3.024 mu in Xinqiu District, the status quo of land is wasteland with vegetation coverage rate 60%.
Gaizhou	● Construction of 12.0 km water distribution pipes with the diameter of DN1000; ● Upgrading two existing water supply plants (Taishan and Henan WSPs); ● Reconstruction of 236 km community secondary pipes in the old residential communities with the diameter of	● The water supply pipe will be laid along the east of 202 Highway, it will temporarily covers an area of 84 mu, including the construction land 17.1 mu, dry field of 18.263 mu, orchard of 48.637 mu (it needs to take up the existing road surface of 202 Highway 150 m x 10 m near

	de50-de315mm, reconstruct of 74 km pipes within the buildings with the diameter of de25-de63mm; ● Reconstruction of 14 community secondary boosting pump station; ● Replacement to intelligent water meters for 32,050 households; ● Construction of one intelligent pipe network system;	Tashan WSP); ● The works of upgrading 2 WSPs will be conducted within the existing WSP areas.

Source: the domestic FSRS and EAs

Figure II-1 Plan of Shenyang Water Supply Pipe Network Construction

Figure II-2 Plan of Anshan Pipe Network Construction

Figure II-3 Layout of Fushun Pipe Network

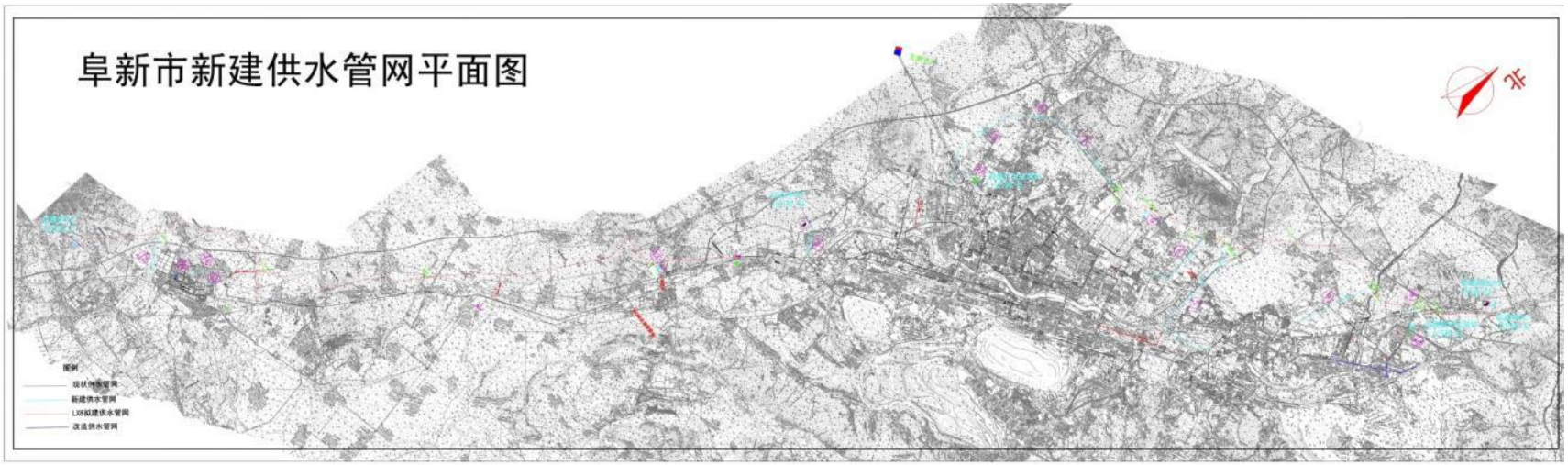


Figure II-4 Plan of Fuxin Pipe Network Construction

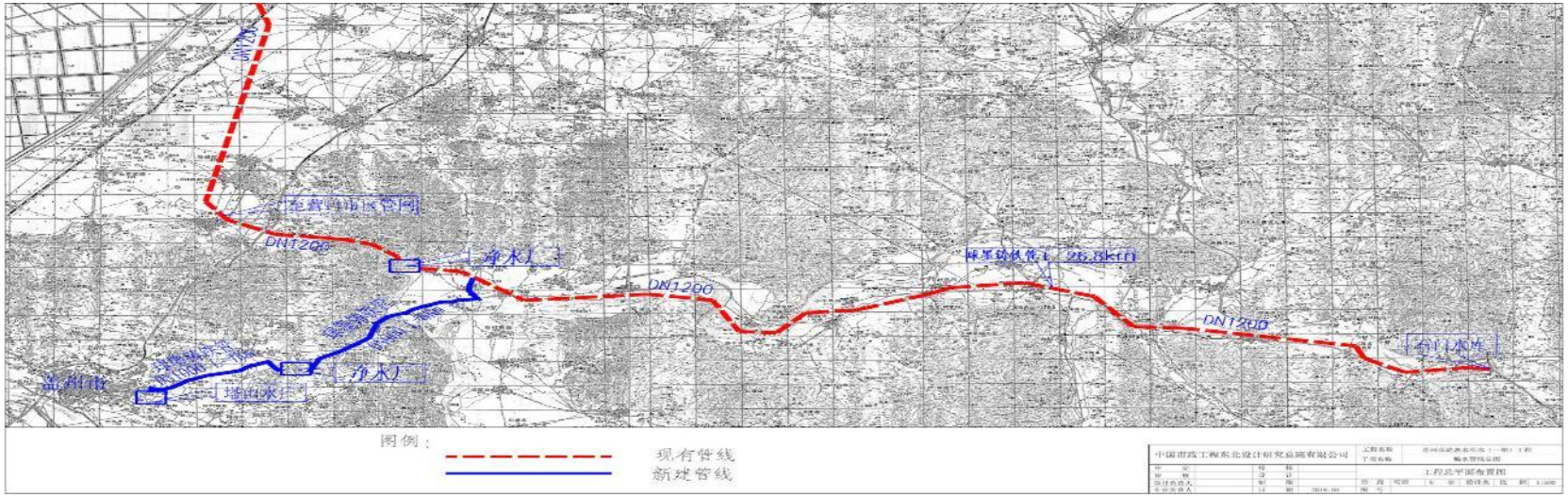


Figure II-5 Layout of Gaizhou Project

III. Policy and Administration Framework for Environmental Assessment

III-1 Applicable PRC's Laws, Regulations and Guidelines

7. The PRC has a wide range of laws, regulations, technical guidelines and standards that govern the way in which environmental protection and environmental impact assessment for construction projects must be implemented, including for pollution prevention and control on air, noise, water, ecology and solid waste, and technical guidelines on assessing atmospheric, noise, water and ecological impacts. The domestic EA Reports upon which this EMP is based was prepared in accordance with the PRC Law on Environmental Impact Assessment (2003), the PRC Management Guideline on EA Categories of Construction Projects (2008), and the Technical Guidelines for Environmental Assessment (HJ/T2-93). The release of the 2006 Interim Guideline on Public Participation in EA has also been a significant development that provides for opportunities to involve the public in the EA process.

8. **Relevant PRC environmental laws, regulations, guidelines, and standards.** The following national laws, regulations, guidelines, and standards, are relevant to the proposed project (**Tables III-1**).

Table III-1 National laws and regulations relevant to this project

Law	Date
Environmental Protection Law	January 1, 2015
Urban and Rural Planning Law	January 1, 2008
Environmental Impact Assessment Law	September 1, 2016
Water Law	Revised in 2016
Cleaner Production Promotion Law	July 1, 2012
Air Pollution Prevention and Control Law	January 1, 2016
Noise Pollution Prevention and Control Law	March 1, 1997
Land Administration Law	August 28, 2004
Water and Soil Conservation Law	March 1, 2011
Water Pollution Prevention and Control Law	June 1, 2008
Solid Waste Pollution Environment Protection Law	April 1, 2005
Antique Preservation Law	June 29, 2013
Regulation	
Pollution Control for Protection Zone of Drinking Water Source	December 22, 2010
National Ecological Environment Protection Programs	April 10, 2001
Environmental Protection Supervision Rules for Construction Projects	November 29, 1998
Classification of Construction Project Environmental Impact Assessment Management (MEP)	September 2, 2008
Temporary Act of Environmental Impact Assessment of Public Participating (MEP[2006]28)	February 14, 2006
Environment and Health Standard for Construction Site	June 1, 2014

Law	Date
（JGJ-146-2013）	
Ordinance on Administration for Environmental Protection of Construction Projects	1998
National Biodiversity Strategy and Action Plan (2011-2030)	2010
Requirement for Social Risk Assessment of Large Investment Projects	2012
National regulation for public disclosure of EIAs (NDRC)	2012

9. The implementation of environmental laws and regulations is supported by associated management and technical guidelines. Those applicable to the project are in **Table III-2**.

Table III-2 Applicable environmental guidelines

Guideline	Year/Code
Technical Guideline on EA: Drinking Water Source Protection	2006
List of Construction Projects Subject to Environmental Protection Supervision	2008
Guideline on EA Classification of Construction Projects	2008
Guideline on Jurisdictional Division of Review and Approval of EAs for Construction Projects	2009
Interim Guideline on Public Consultation for EA	2006
Circular on Strengthening EA Management to Prevent Environmental Risks	2012
Technical Guideline on EA: Surface Water Environment	HJ/T 2.3-1993
Technical Guideline on Environmental Risk Assessment for Construction Project	HJ/T169-2004
Technical Guideline on EA: Acoustic Environment	HJ 2.4-2009
Technical Guideline on EA: Atmospheric Environment	HJ 2.2-2008
Technical Guideline on EA: Ecological Assessment	HJ 19-2011

III-2 Applicable the World Bank's Safeguard Policies

10. The World Bank safeguard policy is to guarantee the environment impact brought by WB financed project could be reduced to acceptable level, including the analysis and environmental mitigation measures for the potential environment impacts. The safeguard policy can avoid the affect and harm to nearby environment and people, improve the project design, enhance the efficiency of project implementation and protect the WB and borrower's reputation. The WB safeguard policy that may be involved and not involved is listed in **Table III-3**.

Table III-3 Relevance Analysis for the Project and WB Safeguard Policy Document

No.	WB Safeguard Policy Document	Triggered?	Explanation
1	OP4.01 Environment Impact Assessment	Yes	The construction and operation could have an impact on surrounding environment, environment impact assessment is required.
2	OP4.04 Natural Habitat	No	The locations of all sub-projects are not contained within natural habitat and reserves, the policy is not correlated.

3	OP4.09 Pest Management	No	The Project is an urban water supply project, the manufacture and usage of pest control products is not involved.
4	OP4.10 Ethnic Minorities	No	The construction site for the Project is urban area and city outskirts, the ethnic minority population accounts for 4.59% of the total based on social assessment report. The Project doesn't involve ethnic minority area.
5	OP4.11 Physical Cultural Resources	Yes	The ranges of construction site do not involve any designated cultural relics reservation area; however, the Shenyang pipeline work will temporarily impact the Nanguan Catholic Church (mainly traffic impact); and pipeline excavation construction many potentially find buried underground cultural relics. Therefor it is related to the policy.
6	OP4.12 Involuntary Resettlement	Yes	The Fuxin projects involve resettlement and land acquisition (permanent land of 51.77 mu, land acquisition and resettlement of 66 people).
7	OP4.36 Forestry	No	The Project doesn't involve woodlands and trees cut down, the policy is not related.
8	OP4.37 Dam Safety	Yes	The resource of water supply includes 4 reservoirs of Dahuofang, Tangshan, Shimen and Naodehai.
9	OP7.60 Disputed Region	No	Disputed region is not involved in the Project
10	OP7.50 International Waterway	No	International waterway is not involved in the Project

11. WB Environmental, Health And Safety Guidelines (EHS)：the applicable EHS guidelines are as follow:

i). WB Environmental, Health And Safety Guidelines (EHS): General EHS Guideline: Introduction;

ii). WB Environmental, Health And Safety Guidelines (EHS)：Air Emissions and Ambient Air Quality;

iii). WB Environmental, Health And Safety Guidelines (EHS)： Wastewater and Ambient Water Quality);

iv). WB Environmental, Health And Safety Guidelines (EHS)：Noise;

v). WB Environmental, Health And Safety Guidelines (EHS)： Electric Power Transmission and Distribution;

vi). WB Environmental, Health And Safety Guidelines (EHS)：Wastes Management.

III-3 Applicable Environmental Standards

12. The environmental quality standard system that supports/evaluates the implementation of the environmental protection laws and regulations in the PRC is classified into two categories by function, i.e. pollutant emission/discharge standards and ambient environmental standards. The standards applicable to this project are in **Table III-4**, and the specific applicable standards for ambient air, water wastewater and noise are listed below.

Table III-4 Applicable environmental standards

Standard	Code
Urban Ambient Acoustic Quality Standard	GB3096-2008
Noise Limit of Industrial Enterprises	GB12348-2008
Noise Limit for Social Activities	GB22337-2008
Drinking Water Quality Standard	GB5749-2006
Surface Water Quality Standard	GB3838-2002
Standard on Pollutant Discharges from Municipal Wastewater Treatment Plants	GB18018-2002
Ambient Air Quality Standard	GB3095-1996
Integrated Emission Standard of Air Pollutants	GB16297-1996
Integrated Wastewater Discharge Standard	GB8978-1996
Noise Limit for Construction Sites	GB12523-1990
Control Standards for Pollutants in Sludge for Agricultural Use	GB4284-1984

a. Wastewater Discharge Standard during Construction Period

13. According to the implementation features of the Project, wastewater generated during construction is domestic wastewater in construction site. The discharge standard is the maximum density of water waste discharged to the urban and town wastewater treatment plant in Liaoning Provincial Wastewater Comprehensive Discharge Standard (DB21/1627-2008) as is shown in **Table III-5**.

Table III-5 Construction Wastewater Discharge Standards (mg/L)

No.	Water Quality Index	Limit
1	COD_{Cr}	300
2	Petroleum	20
3	NH_3-N	30
4	SS	300

Key: COD_{cr} = chemical oxygen demand, SS = suspended solids, NH_3-N = ammonia nitrogen.

b. Wastewater Discharge Standard during Operation Period

14. Wastewater generated during operation is mainly few wastewater by recycled water from filter backwash and domestic wastewater in from water plant and other water supply institutions (pump station and etc.). The discharge standard applies to Comprehensive Discharge Standard (GB8978-1996) as is shown in **Table III-6**.

Table III-6 Integrated Wastewater Discharge Standards (mg/L, except for pH)

Parameter	pH	COD_{Cr}	BOD_5	SS	NH_3-N	Oil

Grade II Standard	6–9	150	30	150	25	10

Key: CODcr = chemical oxygen demand, BOD5 = 5 days biochemical oxygen demand, SS = suspended solids, NH3-N = ammonia nitrogen.

c. Exhaust emission standard during Construction Period

15. The exhaust emission during construction period is mainly unorganized dust emissions, the limit is shown in **Table III-7**.

Table III-7 Air Pollutants Emission Standard (mg/m^3)

Pollution Sources	Pollutants	Maximum Allowable Emission Concentration	Standard Source
Construction site and ambient area	Dust	1.0	《Air Pollutants Comprehensive Emission Standard》 (GB16297-1996) Table 2 Maximum Concentration without the site

d. Noise Emission Standards during Construction

16. The construction period applies to Noise Emission Standard within Construction Site (GB12523-2011), the limit value is shown in **Table III-8**.

Table III-8 d. Noise Emission Standards for Construction Site (dB(A))

Day	Night
70dB（A）	50dB（A）

e. Noise Emission Standards during Operation

17. The noise during operation period is generated from the operation of pumps and blowers, the emission standards applies to Noise Emission Standard for Enterprises and Industries (GB12348—2008). The Project areas are classified as Class II, the area ambient to arterial traffic area is classified as Class IV. The standard is shown in **Table III-9**.

Table I0-9 Acoustic Quality Standards (dB (A))

Standard Category	Day	Night
I	55	45
II	60	50
IV	70	55

f. Occupational Health and Noise Safety Standards

18. The Water and Sanitation Environment, Health and Safety Guideline requires to follow General EHS Guideline, the Project is classified as light industry. The noise limit in different work environment is shown in **Table III-10**.

Table I0-10 Upper Limit of Noise in Different Work Environment in General EHS Guideline (dB (A))

Period of Time / Acoustic Function Category	Equivalent LAeq，8h	Maximum LAmax，fast

Open office, control room, service counter, and etc.	45～50	——
Single office (without noise)	40～45	——
Heavy industry (no need to verbal communication)	85	110
Light industry (need a small amount of oral communication)	50～65	110

19. After the comparison between international and domestic noise emission limits, it could be found that the domestic requirement is stricter then EHS regarding function category. Therefore, the Project will carry out domestic standard. The execution for noise emission standard is shown in **Table III-11**.

T**able I0-11** Execution for Noise Emission Standard **(dB (A))**

Acoustic Function Category	Project content	Period of time		Remark
		Day	Night	
1	Water plant, pump stations and pipeline projects	55	45	Nearby sensitive areas, residential areas, schools, hospitals, etc.
2		60	50	Mixed industrial, residential area
4a		70	55	Arterial traffic area

g. Drinking Water Quality Standards

20. Operation of the WSPs and quality of the treated water to be provided to residents will require compliance with the PRC Drinking Water Quality Standard (GB5749-2006), in which 106 parameters must be met (**Table III-12**).

Table III-12 Drinking water quality standards (GB5749-2006)

No.	Parameter	Limit
	Routine Parameter of Drinking Water Quality	
	Microbiological parameter[2]	
1	Total coliform (MPN/100ml or CFU/100ml)	LD
2	Thermotoletant coliform (MPN/100ml or CFU/100ml)	LD
3	Escherichia Coli (MPN/100ml or CFU/100ml)	
4	Total plant count (CFU/ml)	100
	Toxicological parameter	
5	Arsenic (As, mg/L)	0.01
6	Cadmium (Cd, mg/L)	0.005
7	Chromium Hexavalent (Cr^{6+}, mg/L)	0.05
8	Lead (Pb, mg/L)	0.01

[2] MPN= Most Probable Number; CFU: Colony forming unit.

No.	Parameter	Limit
9	Mercury (Hg, mg/L)	0.001
10	Selenium (Se, mg/L)	0.01
11	Cyanide (CN^-, mg/L)	0.05
12	Fluoride (mg/L)	1.0
13	Nitrate (mg/L)	10 (20 when underground water source)
14	Trichloromethane (mg/L)	0.06
15	Carbon tetrachloride (mg/L)	0.002
16	Bromate (when O3 is applied) (mg/L)	0.01
17	Formaldehyde (when O3 is applied) (mg/L)	0.9
18	Chlorite (when ClO2 is applied) (mg/L)	0.7
19	Chlorate (when compound chlorine dioxide is applied) (mg/L)	0.7
	Sensory Properties and General Chemical Parameter	
20	Chromaticity (Unit of platinum cobalt color)	15
21	Turbidity (diffusing turbidity unit) NTU	1 (3 when water supply and water purification technology conditions)
22	Odor and Taste	No odor, no taste
23	Appearance	None
24	pH	6.5≤X<8.5
25	Aluminum (Al, mg/L)	0.2
26	Iron (Fe, mg/L)	0.3
27	Manganese (Mn, mg/L)	0.1
28	Copper (Cu, mg/L)	1.0
29	Zinc (Zn, mg/L)	1.0
30	Chloride (Cl^-, mg/L)	250
31	Sulfate (SO4-mg/L)	250
32	TDS (mg/L)	1000
33	Total Hardness (CaCO3) (mg/L)	450
34	COD_{Mn} (mg/L)	3 (5 when water source limit and the original water COD_{Mn} ＞6mg/L)
35	Volatile phenols (phenol) (mg/L)	0.002
36	LAS (mg/L)	0.3
	Radioactivity Parameter[3]	
37	Total α radioactivity (Bq/L)	0.5
38	Total β radioactivity (Bq/L)	1

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

No.	Parameter	Limit
	Non-Routine Parameter	
	Microbial indicators	
39	Giardia cysts (count/10L)	<1
40	Cryptosporidium oocysts (count/10L)	<1
	Toxicological parameter (mg/L)	
41	Antimonium (Sb, mg/L)	0.005
42	Barium (Ba, mg/L	0.7
43	Beryllium (Be, mg/L)	0.002
44	Boron (B, mg/L)	0.5
45	Molybdenum (Mo, mg/L)	0.07
46	Nickel (Ni, mg/L)	0.02
47	Silver (Ag, mg/L)	0.05
48	Thallium (Ti, mg/L)	0.0001
49	Cyan chloride (CN^- mg/L)	0.07
50	Chlorodibromomethane (mg/L)	0.1
51	Bromodichloromethane (mg/L)	0.06
52	Dichloroacetic acid (mg/L)	0.05
53	1,2-dichloroethane (mg/L)	0.03
54	Dichloromethane (mg/L)	0.02
55	THMs	1
56	1,1,1 - trichloroethane (mg/L)	2
57	Trichloroacetic acid (mg/L)	0.1
58	Trichloroaldehyde (mg/L)	0.01
59	2,4,6- trichlorophenol (mg/L)	0.2
60	Bromoform (mg/L)	0.1
61	Heptachlor (mg/L)	0.0004
62	Malathion (mg/L)	0.25
63	PCP (mg/L)	0.009
64	HCH (total amount, mg/L)	0.005
65	Hexachlorobenzene (mg/L)	0.001
66	Dimethoate (mg/L)	0.08
67	Parathion (mg/L)	0.003
68	Bentazone (mg/L)	0.3
69	Parathion-methyl (mg/L)	0.02
70	Chlorothalonil (mg/L)	0.01
71	Carbofuran (mg/L)	0.007
72	Lindane (mg/L)	0.002
73	Chlopyrifos (mg/L)	0.03

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

General Parameters and Requirements for Drinking Water Disinfectant

	Disinfectant	Exposure duration with Water	Limit in water supplied (mg/L)	Residue in water supplied (mg/L)	Residues in network peripheral (mg/L)
103	Chlorine and free chlorine (mg/L)	≥30 min	4	≥0.3	≥0.05
104	Monochloramine (total chlorine, mg/L)	≥120 min	3	≥0.5	≥0.05
105	Ozone (O_3, mg/L)	≥12 min	0.3	-	0.02/ ≥0.05 if chlorine is

No.	Parameter				Limit
					added
106	Chlorine Dioxide (ClO_2, mg/L)	≥30 min	0.8	≥0.1	≥0.02

h. Ambient Air Quality Standard

21. PRC uses coal as main fuel, the environment air quality standard shall compliance with PRC standard. After site survey, the air sensitive location for are located at Grade II Air Quality Area. Assessment of ambient air quality was in accordance with Grade II of PRC Ambient Air Quality Standard GB3039-2012, in **Table III-13**.

Table I0-13: Ambient Air Quality Grade II Standard (mg/m^3)

Pollutant		TSP	PM10	SO2	NO2	CO
Grade II Concentration Limits Standard in GB3095-2012	Annual average	200	70	60	40	—
	Daily average	300	150	150	80	4
	Hourly average	—	—	500	200	10

i. Water Quality Standards

22. Surface water quality standard classifies the water function within the Project in accordance with Surface water Environment Function Category. The applicable standards for the proposed project components are PRC Surface Water Environment Quality Standard (GB3838-2002) – Grades III, IV and V respectively (**Table III-14**).

Table I0-14: Surface Water Quality Standards (mg/L, pH excluded)

No.	Water Quality Index	Surface Water Quality Grade		
		Grades III	Grades IV	Grades V
1	pH	6～9	6～9	6～9
2	COD	≤20	≤30	≤40
3	NH3-N	≤1.0	≤1.5	≤2.0
4	Petroleum	≤0.05	≤0.5	≤1.0
5	Sulfide	≤0.2	≤0.5	≤1.0
6	Chloride	≤250	≤250	≤250
7	Fluoride	≤1.0	≤1.5	≤1.5

Key: COD_{Mn} = permanganate index, NH_3-N=ammonia nitrogen.

j. Acoustic Environment Quality Standards

23. In accordance with the PRC Acoustic Environmental Quality Standard (GB3096-2008), the project areas are classified as Class I or II, and areas next to arterial traffic area is classified as Class 4a, the execution of acoustic environment quality standard is shown in **Table III-15**.

Table I0-15 Acoustic Quality Standards (dB (A))

Acoustic	PRC (GB3096-2008)	World Bank Group EHS

Environment	Category	Day	Night	Day （07:00~22:00）	Night（22:00~07:00）
Factory (mixed areas of industrial and residential areas)	II	60	50	70	70
Sensitive areas villages and schools	I	55	45	554	45
Arterial traffic area	IV-a	70	55	——	——

24. It is shown from the data above that the noise guideline values for domestic and WB EHS for residential, office and teaching area are the same; but domestic standard is stricter than WB EHS in industrial and commercial infrastructures; EHS doesn't have requirement for traffic area, mixed commercial and residential areas. Therefore, the Project adopts domestic standard.

III-4 Domestic framework for EA approval and environment management

25. The PRC's Management Guideline of Environmental Protection Categories of Construction Projects (2002) provides detailed classifications of the EA study, including 23 general categories and 198 subcategories based on the project's nature, scale and environmental sensitivity. In accordance with the guideline, the current project was classified into the categories of urban infrastructure, and, water source protection and development.

26. The institutional framework for the EA approval process of the Project involves the Liaoning Provincial Environmental Protection Department (EPD) and the five project cities' Environmental Protection Bureaus (EPBs). The provincial EPD and municipal EPBs will (i) organize experts for the EA evaluation, including compliance with appropriate laws, regulations and standards and (ii) is responsible for final EAs approval; and the five project cities' EPBs are responsible for environmental management and supervision during project implementation, including mitigation measures and environmental monitoring. The authority for each EIA approval is listed in **Table III-16** below.

Table III-16 Domestic EIAs Preparation and Approval

No.	City	EA Institute	Authority for EIA approval
1	Shenyang	Shenyang Lvheng Environmental Consulting Co., LTD	Shenyang Municipal EPB
2	Anshan	Liaoning Ruier Engineering Consulting Co., LTD	Liaoning Provincial EPD5
3	Fushun	Liaoning Yingrui Environmental Consulting Co., LTD	Fushun Municipal EPB
4	Fuxin	Ningxia Zhicheng Anhuan Technology Co., LTD	Fuxin Municipal EPB
5	Gaizhou	Yingkou Environmental Scientism Institute	Anshan Municipal EPB

Source: discussion with the EA institutes

[5] The construction will involve Liaoyang city, so the approval authority is the provincial EPD.

IV. Environmental Baseline of Project Cities

IV-1 Shenyang

(1) City overview

27. Shenyang, the capital of Liaoning Province, is located in the central part of the Province. It's the center of economy, culture, transportation, commerce and trade of northeast China, a large industrial and famous historic and cultural city with a total area of 13,000 km^2, of which the urban area is 3,495 km^2. The population in 2015 is 8.228 million including the registered population of 7.248 million, of which the urban population is 5.221 million.

28. Shenyang is one of the national heavy industry bases that give priority to equipment manufacturing industry constructed at the early stage of the founding of the PRC. After development for several decades, Shenyang's industrial categories have reached 142. There are 3,033 large-scale industrial enterprises by the end of 2015. The regional gross domestic product (GDP) was RMB 728 billion yuan in 2015.

29. **Weather and hydrology:** Shenyang is located at the east of Eurasia and has temperate continental monsoon climate with long, cold winters and short, warm summers. The average temperatures range from 6.2℃ to 9.7℃, the extreme maximum temperature and minimum temperature were 38.3℃ and -32.9℃, respectively. The average annual precipitation is 600-800 mm, mostly occurring during July to September.

30. **Topographic and geology:** The project area (Shenyang urban area) is high terrace, belonging to the Changbai Mountains, with altitude of 40-60m above sea level (ASL), from northeast to south gradually incline. The topographic structure is loess material accumulation and bedrock. The geologic condition of the project area is that the stratum is Quaternary alluvium, whose lithology are topsoil layer, sandy clay layer and gravel sandy layer from up to down. Surface layer thickness is 0.75-1.0 m, sandy clay layer thickness is 5-10 m, and gravel pebble layer thickness is more than 20 m.

31. **Hydrological Condition:** Groundwater is abundance in Shenyang, porous diving, stored in the Quaternary gravel layer. The main recharge of groundwater is precipitation, and the average groundwater table is 7-8 m. There are six (6) rivers in Shenyang Municipality, including Liao River, Hun River, Raoyang River, Liu River, Pu River, Yangxi River, Beisha River and Xiushui River. The total annual utilizable water resource is 2.314 billion m^3 including surface water resource of 380 million m^3 and groundwater resource of 1.934 billion m^3.

(2) Current status of construction site

32. The proposed Shenyang municipal pipeline constructions will be laid under the existing municipal roads (non-motorized lanes); while the residential courtyard pipe works will be laid under the residential community' path, small part of the pipes will pass through greenbelts within the residential yards, the path and grassland will be recovered after the pipes are constructed. The proposed pumping station works will be conducted within the existing sites of the WSC without any land acquisition and resettlement.

(3) Environmental baseline

33. The baseline data are collected from the Environmental Quality Report of Shenyang City in the year of 2014 by the EA Institute.

34. **Ambient air:** The air monitoring data of Environmental Quality Report of Shenyang City in the year of 2014 is shown in the Table IV-1

Table IV-1 Baseline of Ambient Air Quality in Shenyang City (2014)

Item	PM_{10}	$PM_{2.5}$	SO_2	NO_2	CO	O_3 (8h)
Annual Average Concentration (μg/m³)	124	74	82	52	1.1	-
Annual Standard (μg/m³)	70	35	60	40	-	-
Exceeding the Multiple (multiple)	0.77	1.11	0.37	0.30	-	-
Percentile Concentration in 24 hours (μg/m³)	231	165	287	5	2.0	1 5
Percentile Standard in 24 hours (μg/m^3)	150	75	150	80	4	160
Exceeding the Multiple (multiple)	0.54	1.20	0.91	0.19	-	0.03
Standard Ratio of Daily Average Concentration (%)	72.3	6 .3	81.6	91.5	100	88.8

Source: the domestic EA

35. The baseline data show that:

i) The average annual concentration of PM_{10} was 124μg/m³, exceeded the Grade II Ambient Air Quality Standard (GB3095-2012) for 0.77 times; the average daily percentile concentration was 231μg/m³, exceeded the standard multiple is 0.54; and the average daily standard-achieved rate in 2014 was 72.3%;

ii) The average annual concentration of $PM_{2.5}$ was 74μg/m³, exceeded the Grade II Standard for 1.11 times; the average daily percentile concentration was 165μg/m³, exceeded the standard multiple is 1.2; the average daily standard-achieved rate was 63.3%;

iii) The average annual concentration of the Sulfur dioxide (SO_2) was 82μg/m³, exceeded the Grade II ambient air quality standard for 0.37 times; the average daily concentration was 287μg/m³, exceeded the standard multiple is 0.91; and the average daily standard-achieved rate was 81.6%;

iv) The average annual concentration of the Nitrogen dioxide (NO_2) was 52μg/m³, exceeded the Grade II standard for 0.3 times; the average daily concentration in 2014 was 95μg/m³, exceeded the standard multiple is 0.19; and the average daily standard-achieved rate was 91.5%.

v) The average annual concentration of the carbon monoxide (CO) was 1.1μg/m³; the average daily concentration in 2014 was 2.0μg/m³; and the average daily standard-achieved rate was 100%.

vi) The average 90th percentile concentration in 24-hour of the max sliding average value of eight hours of Ozone was 165μg/m³, exceeded the standard multiple is 0.03; and the standard-achieved days in 2014 was 324 days, with standard-achieved rate of 88.8%.

36. **Surface water quality of South Canal:** In 2014, the water quality of South Canal was worse than Grade V of the Surface Water Quality Standard of GB3838-2002, heavily polluted. The main pollutants were petroleum, NH3-N and TP. Of which, the average annual petroleum concentration was 1.27 mg/L, 24.4 times exceeded the Grade III Surface Water Quality Standard of GB3838-2002; and the annual mean value of NH_3-N was 3.3 mg/L, 2.3 times exceeded the Grade III standard; the annual average value of TP was 0.45 mg/L, 1.3 times exceeded the Grade III Standard. The monitoring results of the South Canal in 2014 are shown in Table IV-2.

Table IV-2 Surface Water Quality of South Canal in 2014

Item / Month		CODcr	BOD_5	$KMnO_4$	NH_3-N	TP	Petroleum	Volatile phenol	Quality grade
May	Average Value	17	4	4.9	3.13	0.25	1.78	0.0024	Worse than Grade V
	Exceeding Multiple	-	-	-	2.1	0.3	34.7	-	-
Aug.	Average Value	21	4	4.5	3.82	0.66	1.70	0.0015	Worse than Grade V
	Exceeding Multiple	0.05	-	-	2.8	2.3	32.9	-	-
Oct.	Average Value	20	5	5.7	2.95	0.44	0.32	0.0010	Worse than Grade V
	Exceeding Multiple	-	0.4	-	2.0	1.2	5.3	-	-
Annual Average	Average Value	19	4	5.0	3.3	0.45	1.27	0.0016	Worse than Grade V
	Exceeding Multiple	-	-	-	2.3	1.3	24.4	-	-
Maximum Concentration		21	5	5.7	3.82	0.66	1.78	0.0024	-
Exceeding Multiple		0.05	0.4	-	2.8	2.3	34.7	-	-
Minimum Concentration		17	4	4.5	2.95	0.26	0.32	0.0010	-
Exceeding Multiple		-	-	-	2.0	0.63	5.3	-	-
Exceeding Rate		33.3	33.3	0	100	100	100	0.0	-
Grade III Standard of GB3838-2002		≤20	≤4	≤6	≤1	≤0.2	≤0.05	≤0.005	-

Source: the domestic EA

37. **Acoustic environment:** The proposed pipeline will be constructed along the municipal roads, so the baseline data in the domestic EA was from the Environmental Quality Report of Shenyang City in the year of 2014.

38. In 2014, the average traffic sound environmental quality in Shenyang was 69.8dB. According to the stipulation of the road traffic noise intensity grade in the "Technical Specifications for Monitoring of Environmental Noise - Routine monitoring for urban acoustic environment" (HJ640-2012), the applicable sound environmental quality is Grade II. The noise intensity level of the 30 road sections out of the 47 road sections monitored is Grade II or better

than Grade II, rated as to the good or the moderately good. The length of 30 road sections is 88.5 km, accounting for 62.8% of the total monitored road length. The noise intensity levels of the 17 road sections out of the 47 road sections are Grade III or worse than Grade III with noise monitoring value higher than 70dB. The length of the 17 road section is 52.3 km, accounting for 37.2% of the total monitored road length.

(4) Situation of Shenyang water supply system

39. The water supply system of Shenyang City was founded in 1915. The raw water sources of urban water supply include both groundwater and surface water. The ground waters are mainly along the riversides of the Hun River and the Liao River, while the surface water is from Dahuofang Reservoir in Fushun Municipality. In 2015, the maximum and average daily water supply amounts were 1.637 million m^3 and 1.462 m^3, respectively, of which the surface water is 0.923 million m^3 (accounting for 63%), and the groundwater is 0.539 million m^3 (accounting for 37%).

40. **The existing WSPs.** Shenyang Water Supply Company has nine (9) WSPs with the total water supply capacity of 1.985million m^3/d. The maximum water supply in 2015 was 1.806million m^3/d. In addition to the surface water intake in the Dahuofang Reservoir, there are 32 groundwater sources with 552 wells and 53 water tanks with the total volume of 305,000 m^3, accounting for 20% of the total water supply capacity; and there are 22 raw water pumping stations with 102 pumps in Shenyang.

41. **The water distribution pipe network.** The total lengths of municipal water supply pipeline and the pipeline within the residential communities in the urban area are 3,031.8 km and 2,850 km, respectively. The length of trunk raw water transmission pipeline is 636 km with the diameter of DN700~DN2000. The materials of distribution pipe include PE, DIP, steel and fiberglass, etc. There are 7,056 valves and 4,286 outdoor fire hydrants in the urban area.

42. The water distribution system in the urban area widely adopts secondary water supply, with the coverage rate of more than 90%, and 1,829 secondary water supply pump stations in total. The water storage capacity of secondary water supply is 400,000 m^3, and adjustable volume of water supply is more than 20% of the total. Due to aged pipeline in urban area, the water leakage accidents were frequently occurred, according to statistics, the average pipeline leakage accidents in 2009 - 2010 are 1000 - 1800 times annually, of which DN75~DN200 pipeline leakage accidents accounted for 65% to 77%. In 2014 - 2015, the average pipeline leakage rate was 21.69%. The frequent pipeline leakage causes low water supply pressure in the distribution network, which is one of the main reasons for the widely use of secondary booster pumping water supply in the urban area.

43. **The major weaknesses in the water supply system.** The aged water supply network causing high leakage rate. In the total 3,031.8km water supply pipe network in Shenyang, those running over 50 years are 242 km (accounting for 8% of the total) and over 40 years are 500 km (accounting for 16.5%), respectively. The aged pipes increase both the power consumption and water resource loss.

IV-2 Anshan

44. Located in the center of Liaoning Province, 89 kilometers south of Shenyang, Anshan is the third biggest cities in Liaodong province, after Shenyang and Dalian. Anshan covers an area of about 9,252 km^2, and total population of 3.584 million including urban population of 1.467

million in 2015. Anshan was known in China as "The Capital of Steel Industry. The regional GDP in2015 was RMB 232.6 billion yuan.

(i) Natural Environment

45. **Weather and hydrology.** Anshan is under the continental monsoon climate in the warm temperate zone, with neither severe cold in winter nor intensive heat in summer, and with four distinct seasons, the average temperatures range from 8.0℃ to 9.0℃. the extreme maximum temperature and extremely minimum temperature were 36.9℃ and -30.4℃, respectively. The average annual precipitation is 640-840 mm, mostly occurring during July to September.

46. **Topography:** The topographic features of Anshan City are higher in the southeast, and lower in the northwest, inclined from southeast to northwest. Southeast is the extension part of the Qianshan Mountains, generally at the elevation of 300 to 600 m ASL; The highest point is Maokui hill of Xiuyan mountain, 1,141 m ABL. The middle area is the transition zone of Qianshan Mountains to the western alluvial plain, is low hills and gully region, with the general elevation of 100 to 200m ASL. The west of the Chang-Da Railway is the alluvial plains of Liao River, Hun River and Taizi River, with the elevation of 5 to 20m ASL. The lowest elevation is Yangtang Village, Jiucaitai Town, Tai'an County, with the elevation of only 2 m ASL.

47. **Hydrological Condition:** There are more than 30 rivers in Anshan city, among which, the large rivers are Liao River, Hun River, Taizi River, Dayang River, and Shaozi River. The rivers flowing through the urban area are Nansha River, Yunliang River, Yangliu River and the tributaries of Taizi River, of which the largest one is Nansha River, with the total basin area of 401 km^2, and the average annual runoff of 71 million m^3. The total annual utilizable water resource of Anshan is 15.24 billion m^3 including surface water of 211 million m^3 and groundwater of 1.313 billion m^3.

(ii) Current status of construction site

48. The proposed Anshan municipal pipeline constructions will be laid under the existing municipal roads(non-motorized lanes); while the residential courtyard pipe works will be laid under the residential community' path, small part of the pipes will pass through greenbelt within the residential yards, the path and grassland will be recovered after the pipes are constructed. The proposed Wangjiayu WSP and the pumping station works will be conducted within the existing sites of the WSC without any land acquisition and resettlement.

(iii) Environmental Baseline

49. **Baseline of ambient air in urban area:** The physical constructions of Anshan subprojects include the rehabilitation Wangjiayu WSP and Tanghe water source pumping station, and pipeline construction in the urban area. The baseline data of air and surface water within Anshan urban area were collected from the Environmental Quality Report of Anshan City in the year of 2015 by the EA Institute (Table IV-3), while the data of air and surface water for the Tanghe water source, as well as the noise baseline of both the urban area and surrounding the water source were provided by Dalian Jingcheng Testing Technical Company.

Table IV-3 Baseline of Ambient Air in Anshan Urban Area in 2015 (μg/m3)

Item	PM10	PM2.5	SO2	NO2
Average annual value	120	69	55	9
Standard Exceed multiple	0.71	0.97	Meet the standard	Meet the standard

Grade II Standard of GB3095-2012	70	35	60	40

Source: the domestic EA

50. **Baseline of ambient air surrounding the water source pumping station.** Ambient air quality was monitored at Xiaodao Village on 200m north of the proposed site, where Grade II of Ambient Air Quality Standard (GB 3095-1996) was applied. Sampling was conducted for three consecutive days from 24-26 September 2016 (four times sampling each day). Four parameters were sampled (Table IV-4). The monitoring result shows that all the monitored parameters met the Grade II Standard.

Table IV-4 Baseline of Ambient Air nearby the Water Source Pumping Station

(Hourly average, **μg/m3)**

Date	Time	SO2	NO2	Cl2	PM10 (Daily average)
24 Sep. 2016	2:00	13	13	Non-detected	134
	8:00	14	13	Non-detected	
	14:00	12	13	Non-detected	
	20:00	11	12	Non-detected	
25 Sep.2016	2:00	12	14	Non-detected	148
	8:00	11	15	Non-detected	
	14:00	9	13	Non-detected	
	20:00	10	11	Non-detected	
26 Sep.2016	2:00	13	14	Non-detected	111
	8:00	8	15	Non-detected	
	14:00	12	14	Non-detected	
	20:00	11	12	Non-detected	
Grade II Standard		50	20	10	150
Standard-achieved		met	met	met	exceeded

Source: the domestic EA

51. Baseline of the surface water quality in Anshan urban area: The baseline data of surface water within Anshan urban area were collected from the Environmental Quality Report of Anshan City in the year of 2015 by the EA Institute (Table IV-5). Where the applicable standard is the Grade IV Surface Water Quality Standard of GB3838-2002. The baseline data show that both the COD_{cr} and NH_3-N exceeded the standard due to domestic sewer discharge into the rivers.

Table IV-5 Baseline of Surface Water in Anshan Urban Area in 20015 (mg/L)

River section	Nansha River (Chengangpo)		Yunliang River (Hada Bridge)		Yangliu River (Xintaizi)		
Pollutant	Average	Exceeded multiple	Average	Exceeded multiple	Average	Standard	Exceeded multiple
CODcr	35.1	0.17	38.1	0.27	29	30	met
NH3-N	4.87	2.25	5.79	2.86	4.23	1.5	1.82

Source: the domestic EA

52. **Baseline of the surface water quality nearby the water source pumping station:** the sampling was conducted at the points of Tanghe River, 500m upstream and 500 m downstream from the site of the pumping station. The sampling was once per day for two consecutive days (2–25 September 2016). Five water quality parameters were monitored (Table IV-6). The national standard adopted for the water quality assessment is Grade II Surface Water standard

(GB 3838-2002). The monitoring result shows that all the monitored parameters met the Grade II Standard of GB3838-2002.

Table IV-6 Baseline of Tanghe River Water Quality (mg/L)

Sampling point	Date	pH	CODcr	NH3-N	SS	Petroleum
Upstream of Tanghe River	24 Sep.2016	6.53	12.9	0.39	5	0.03
Downstream of Tanghe River	25 Sep.2016	6.56	11.0	0.385	6	0.02
Upstream of Tanghe River	24 Sep.2016	6.61	14.0	0.493	4	0.01
Downstream of Tanghe River	25 Sep.2016	8.69	12.1	0.490	7	0.01
Standard value		6-9	15	0.5	--	0.05
Standard archived		met	met	met		met

Source: the domestic EA

53. **Baseline of noise:** Noise monitoring was conducted at 54 points, comprising 4 at the boundaries of the Tanghe River water source pumping station (No.1-4), 4 at the boundaries of Wangjiayu WSP (No. 6-9), 44 points at residential communities and schools near the pipeline routes in the urban area (No. 5 and 10-54), respectively. Monitoring was conducted on two consecutive days from 24–25 September 2016. In accordance with PRC Acoustic Environmental Quality Standard (GB3096-2008), assessment areas for construction of new pipelines along roads are classified as the Grade I, Grade II or Grade 4a. Sensitive areas such as schools, hospitals, residential communities and other sensitive spots are assessed based on the acoustic environment function zoning identified by the local EPB. The applicable environmental noise standard values and the applicable areas are in Table IV-7. The monitoring results show that the noise level at all points met the related standards.

Table IV-7 Baseline of Noise (dB)

No.	Monitoring point	24 Sep. 2016	25 Sep. 2016	Standard value
		Day/night	Day/night	Day/night
1	East boundary of Tanghe pumping station	50.2/40.0	51.4/40.9	55/45 (Grade I)
2	South boundary of Tanghe pumping station	52.0/39.7	52.8/441.5	55/45 (Grade I)
3	West boundary of Tanghe pumping station	51.0/40.5	52.0/41.6	55/45 (Grade I)
4	North boundary of Tanghe pumping station	51.6/40.9	51.2/42.4	55/45 (Grade I)
5	Residential area of Xiaodao Village	52.7/40.9	50.5/40..1	55/45 (Grade I)
6	East boundary of Wangjiayu WSP	55.6/3.1	54.5/41.6	60/50 (Grade II)
7	South boundary of Wangjiayu WSP	55.1/41.7	55.0/41.1	60/50 (Grade II)
8	West boundary of Wangjiayu WSP	54.9/41.1	566.0/42.5	60/50 (Grade II)
9	North boundary of Wangjiayu WSP	56.7/41.8	56.7/42.1	60/50 (Grade II)
10	Yulianwan Residential Community	56.3/43.1	57.1/41.1	60/50 (Grade II)
11	Hainuoshoufu Residential Community	56.1/3.1	55.2/2.9	60/50 (Grade II)
12	The residential community at west of Zhanqian Street.	51.8/41.6	52.7/41.5	55/45 (Grade I)
13	Ethnic Kindergarten	52.2/40.5	50.3/40.2	55/45 (Grade I)
14	Xishanhe Residential Community	50.9/41.0	53.3/40.2	55/45 (Grade I)
15	Wenhua School	54.5/41.0	50.3/41.1	60/50 (Grade II)
16	Residential area at south of Hongtaigou Pumping Station	51.8/40.5	53.5/40.5	55/45 (Grade I)
17	No.1 Qianshan Pumping Station	53.6/41.7	53.3/2.4	70/55 (Grade 4a)
18	No.2 Qianshan Pumping Station	50.5/40.8	52.8/40.7	55/45 (Grade I)
19	Honglou Residential Community	54.8/40.4	52.9/42.8	60/50 (Grade II)

No.	Monitoring point	24 Sep. 2016	25 Sep. 2016	Standard value
		Day/night	Day/night	Day/night
20	Tanggangzi School	49.4/39.5	53.8/38.4	55/45 (Grade I)
21	Tanggangzi Sanatorium	45.2/39.8	44.9/39.5	55/45 (Grade I)
22	Tianherenjia Residential Community	51.3/40.9	50.0/40.2	60/50 (Grade II)
23	No. 63 Middle School	48.2/40.8	47.7/41.0	55/45 (Grade I)
24	The workers' dormitory of the NO.3 Metallurgy Company	60.7/2.6	59.8/42.8	70/55 (Grade 4a)
25	Lishanjinyuan Residential Community	61.4/42.1	60.7/42.3	70/55 (Grade 4a)
26	No. 8 Middle School	53.7/42.6	544.0/442.1	55/45 (Grade I)
27	No. 48 Middle School	50.1/440.9	50.5/440.1	55/45 (Grade I)
28	No.42 Kindergarten of Anshan Steel Co.	43.7/40.1	442.2/40.1	55/45 (Grade I)
29	Shuangshan Hospital	53.1/41.7	53.9/41.2	55/45 (Grade I)
30	Boyuan Senior High School	51.3/41.7	50.1/440.1	55/45 (Grade I)
31	No.51 Middle School	53.44/41.9	53.7/40.8	55/45 (Grade I)
32	Honghaocheng Residential Community	62.7/45.1	63.8/42.6	70/55 (Grade 4a)
33	Tuanjie Residential Community	57.2/41.6	52.2/41.7	70/55 (Grade 4a)
34	No.35 Middle School	54.3/42.6	54.6/42.6	55/45 (Grade I)
35	Shijifengjing Residential Community	63.2/41.5	62.5/42.5	70/55 (Grade 4a)
36	No.10 Kindergarten	61.4/40.7	62.9/41.4	70/55 (Grade 4a)
37	No.68 Middle School	53.2/41.7	53.4/40.3	55/45 (Grade I)
38	Tiedong District Hospital	53.7/41.8	53.4/40.3	60/50 (Grade II)
39	Kaishengfaner Residential Community	52.4/42.1	51.4/42.1	55/45 (Grade I)
40	Anshan Weather Bureau	53.2/42.7	54.1/42.1	55/45 (Grade I)
41	Sifangtai Village	49.2/41.9	47.4/41.6	60/50 (Grade II)
42	Changdajiayuan Residential Community	54.7/41.7	53.9/40.1	55/45 (Grade I)
43	Banfu Town Residential Community	59.2/40.8	57.9/41.2	70/55 (Grade 4a)
44	Residential Area at south of Qingfeng Alley	53.3/41.8	53.2/40.6	55/45 (Grade I)
45	Tiexi District Bureau of Justice	51.3/42.6	449.8/42.1	60/50 (Grade II)
46	Debao Middle School	47.2/42.1	45.0/40.0	60/50 (Grade II)
47	Anshan No.2 Hospital	50.7/43.7	50.3/40.1	60/50 (Grade II)
48	No.46 Middle School	53.1/42.1	54.7/40.6	60/50 (Grade II)
49	Rixin Residential Community	50.7/43.7	50.0/41.7	60/50 (Grade II)
50	Fengheyuan Residential Community	51.3/41.7	51.2/41.3	55/45 (Grade I)
51	Lvsezhihui Residential Community	51.3/42.2	50.8/41.2	55/45 (Grade I)
52	Huisile Residential Community	49.2/41.5	48.2/40.9	55/45 (Grade I)

Source: the domestic EA

(iv) The situation of Anshan urban water supply system

54. **The water source and WSPs.** The Anshan water supply system is composed of three parts: the municipal water supply system; water supply system of Anshan Iron and Steel Co., and the water supply system owned by the industrial and mining enterprises. The municipal water supply system is the main part.

55. There are four water sources for the municipal water supply system, of which two surface water sources are Tanghe River with the capacity of 350,000 m^3/d, and Laohushan WSP with the capacity 150,000 m^3/d; Two groundwater sources are: Dazhaotai WSP with the capacity of

20,000m^3/d, and West suburb water source with the capacity of 30,000 m3/d. The designed water supply capacity of the municipal system is 577,500m^3/d, while the current maximum water supply is 470,000m^3. The current NRW is 39%, and the tap water supply coverage is 93%. The total urban population is 1.467 million, of which the water supplied population by the municipal water supply system is 1.3881 million.

56. Tanghe River is the largest surface water source for Anshan City, which was a large-scale water supply project financed by the Japanese loan. The WSP includes Phase I and Phase II, with the designed capacities of 350,000m^3/d, including Phase I of 200,000m^3/day and Phase II of 150,000m^3/day. The Phase I of the project was completed in July 1993 and the phase II was completed in 2010. The system includes reservoir water intake, raw water transmission pipeline, water treatment, and water distribution. Wangjiayu WSP is the largest one in Anshan City, which supplies water to the districts of Tiedong, Lishan and Qianshan in the City, accounting 70% of the city's total water supply amount. But the water quality of WSP cannot meet the national Drinking Water Quality Standard of GB5749-2006. The west suburb water source is located 6 km away from the urban area, including a group of wells and the WSP, with the water supply amount of 30,000m^3/d.

57. **The distribution pipeline network**. The total length of existing water distribution pipeline is 2,526 km, in which about 300 km pipes have been operating for more than 30 years. The aged pipeline cases high NRW and water quality problem.

Figure IV-1+2 Aged pipes resulting high NRW

Figure IV-3+4 rusty Pumping Equipment

58. **The secondary water supply system.** The urban area of Anshan City is 154.3km^2, about 10km from north to south and 7 km from east to west. The feature of landscape is higher in the east and south and lower in west and north, with 97m elevation difference maximally (114 m ASL in Tiedong District and 17 m ASL in Tiexi District). In order to meet the residential

communities located on higher elevation area, without increasing the pressure of municipal pipe network, there are 406 secondary booster pumping stations, which supply water to about 350,000 urban residents.

59. There are 624,000 residential tap water consumers in the urban areas, and 138,800 water meters have been operating for more than 10 years (generally, water meter life cycle is 6 years). Although the Anshan water supply company used its own fund to update partial water meters each year, but still more aged water meters in operation. The most water meters are old rotating type, with large metering error.

IV-3 Fushun

60. Fushun is located in the center of Liaoning Province, 45 km south of Shenyang, with the total area of 11.271 km^2 and the population of 2.19 million in 2015, including urban population of 1.41 million. Fushun was known in China as "The Capital of Coal Mine. The regional GDP was RMB 127.66 billion yuan in 2015.

(i) Natural Environment

61. **Weather and hydrology:** Fushun is under the continental monsoon climate in the warm temperate zone, with four distinct seasons, the average temperatures range from 5.0℃ to 7.0℃. the extreme maximum temperature and extremely minimum temperature were 36.9℃ and -30.4℃, respectively. The average annual precipitation is 760-790 mm, mostly occurring during July to September.

62. **Topographic and Geology:** Fushun is located in the alluvial plain of Hun River valley with hills in the south and north. The average elevation of the municipality is 65 to 99 m ASL. The city is strip layout along the Hun River, with the length over 30 km from east to west, and the width of 6 ~ 8km from north to south. The terrain gradually reduced from east to west, and the slope is one thousandth. The entire urban area is separated into the six blocks of South River, North River, Wanghua, Dongzhou, South, Zhangdang by the Hun River, its tributaries and two opencast coal mines. Dahuofang Reservoir is located upstream of the eastern part of the city, with the capacity of 2.1 billion m^3. The geological tectonics belongs to the Cenozoic Quaternary geology.

63. **Hydrological Condition:** The largest river in the city is Hun River, which is originated in the Gunmaling hill of Changbai Mountains, in the Qingyuan Manchu Autonomous County, and flows westward through Fushun and Shenyang to Sancha River, and then flows to the Daliao River after the confluence of Sancha River and Taizi River, finally flows into the Bohai Sea through Yinkou Municipality. The length of the main stream is 415km, with watershed area of 11,481 km2. The length of Fushun section of Hun River downstream from the Dahuofang Reservoir to the Sifangtai is 38.5km, with river width of 290 ~ 1000m, the slope of 0.85%, and the average flow in the dry season is 8.2 m3/s and only 2.6 m3/s in winter. The main surface water sources in the city are Hun River, Dahufang Reservoir, Shifusi Reservoir. The average annual water resource is 9.13 billion m^3 including surface water of 9.09 billion m^3 and groundwater of 859 million m^3.

(ii) Current status of construction site

64. The proposed Fushun municipal pipeline constructions will be laid under the existing municipal roads(non-motorized lanes); while the residential courtyard pipe works will be laid

under the residential community' path, small part of the pipes will pass through greenbelt within the residential yards, the path and grassland will be recovered after the pipes are constructed. The proposed pumping station works will be conducted within the existing sites of the WSC without any land acquisition and resettlement.

(iii) Environmental Baseline

65. **Ambient air:** According to the data from "Environmental Quality Report of Fushun City (2015)", in the year of 2015, there were 362 air quality monitoring effective days, of which 260 days reached the standard quality, with standardized rate of 71.8%. In the six pollutants, the annual average concentration of PM10 is 94ug/m3, exceeded the Grade II quality standard of 0.34 times; the annual average concentration of PM2.5 is 53μg/m3, exceeded the Grade II standard of 0.51 times. The annual average concentrations of SO2, NO2 are 31 μg/m3 and 34μg/m3, respectively; the daily average concentration of CO and O3 were 2.5μg/m^3 and149μg/m^3, respectively, which all meet the Grade II standards.

66. **Noise:** According to the "Environmental Quality Report of Fushun City (2015)", in 2015, the sound environmental compliance rate of Fushun functional area was 70.0%. Among them, the average value of daytime acoustic environmental quality was 55.4dB, with compliance rate of 80.0%; while the nighttime average value was 48.7dB, with compliance rate of 60.0%. The sound environment of Class 0, Class 1 and Class 2 during daytime and nighttime are all met the standard. The acoustic environment of Class 3 during daytime was all met the standard and the sound environment at night was all exceeded the standard. The monitoring results of acoustic environment in functional areas of Fushun in 2015 are shown in Table IV-8.

Table IV-8 The Baseline of Acoustic Environment in Fushun in 2015 Unit: dB (A)

Quarter	Class 0		Class 1		Class 2		Class 3		Class 4		Average Value	
	Day	Night	Day	Night	Day	Nigh	Day	Night	Day	Night	Day	Night
I	42.3	37.1	46.1	40.2	53.3	43.4	62.1	59.7	72.8	63.5	55.3	48.8
II	42.8	36.3	50.4	40.2	54.0	44.6	60.5	58.9	72.8	60.3	56.1	48.1
III	41.8	36.4	48.3	45.0	52.2	46.6	60.9	59.9	72.7	61.7	55.2	49.9
IV	41.6	37.3	47.4	42.0	52.6	41.8	60.3	58.5	72.1	60.9	54.8	48.1
Annual	42.1	36.8	48.1	41.9	53.0	44.1	61.0	59.3	72.6	61.6	55.4	48.7

Source: Domestic EA

67. **Surface Water:** According to the "Environmental Quality Report of Fushun City (2015)", the water quality of Zhangdang River was Grade V surface water standard. Of the monitoring parameters, the BOD_5, petroleum, TP exceeded the Grade III standard, and the remaining parameters all met the standards.

Table IV-9 Environmental Quality Data of Zhangdang River

Parameter	CODcr	BOD5	Petroleum	NH_3-N
Max Value	34	12	0.17	1.34
Min Value	5	1.5	0.04	0.059
Average Value	18.1	5.8	0.09	0.410
Exceeding the Standard Rate %	33.3	58.3	66.7	8.3

Grade III Standard	20	4	0.05	1.0

Source: the domestic EA

68. According to the "Environmental Quality Report of Fushun City (2015)", the water quality of Haixin River section was worse than Grade V Standard. The pollutants exceeded standards were NH_3-N, TP and petroleum.

Table IV-10 Baseline of Haixin River

Parameter	COD	BOD	Petroleum	NH_3-N
Max Value	36	9.8	0.25	9.31
Min Value	5	2.6	0.01	0.797
Average Value	22.8	5.5	0.1	4.09
Exceeding the Standard Rate %	8.3	33.3	0	33.3
Grade IV Standard	30	6	0.5	1.5

Source: the domestic EA

69. **Water quality of the Hun River:** The monitoring results show that the water quality of Fushun section of Hun River met the Grade IV water quality standards. In the whole river section monitoring, the average value of petroleum met Grade IV standard; The TP met the Grade III standard; the permanganate index, BOD_5 and NH_3-N met the Grade II standard, and the rest parameters met the class I standard.

70. In 2015, according to the monitoring dada, the average water quality of Hun River (Funshun Urban section) met the Grade IV surface water standard. Of the monitoring parameters, the average value of petroleum met the Grade IV standard, and the TP met the Grade III Standard, and the permanganate index, BOD_5 and NH_3-N met the Grade II Water Quality Standards, and the other parameters monitored met the Grade I Standard.

(v) The situation of Fushun water supply system

71. **The water supply company:** Fushun Water Supply Company was established in 1908, which now is a large state-owned enterprise for public utility service. By the end of 2015, the company has 1,543 staff, with the total assets of 1.68 billion RMB, and the total tap water supply service area of 95 km^2, and service population of 1.267 million. The Company has five branches of Dongzhou, Fengze, Hetai, Henan and Hebei.

72. **Water source:** The raw surface water of city is from the Dahuofang Reservoir and transmitted by gravity through open channels and pipeline to the eight (8) WSPs of Wujiabao, Dongzhou, etc.

73. Fushun City includes four water supply zones of Eastern, Central, Wanghua and the Economic Development Area. There are two WSPs of Wujiabao and Dongzhou in the eastern zone; three WSPs of Hebei, Jiangjun and Donggongyuan in the central zone, two WSPs of Ditai and Haicheng in Wanghua zone, and two WSPs of Heping and Lagugong in the Economic Development Zone. All the WSPs with their own separate distribution networks.

74. **The WSPs.** The water supply capacity and maximum water supply amount of each WSP are shown in the table below.

Table IV-11 Maximum Water Supply Amount of WSPs in Fushun

Zone	Name of WSP	Water supply capacity	Maximum water supply amount	Year for putting in operation
Eastern	Wujiabao	200,000	100,000	1983
	Dongzhou	20,000	18,000	1968
Central	Hebei	100,000	90,000	1982
	Jiangjun	200,000	145,000	1993 (Phase I)/2004(Phase II)
	Donggongyuan	100,000	85,000	1908(Phase I)/2003(Phase II)
Wanghua	Ditai	100,000	78,000	1973(Phase I)-1990(Phase II)
	Haiyu	50,000	48,000	1992
Economic Development Zone	Heping	50,000	50,000	2007
	Total	**820,000**	**614,000**	

Source: the domestic EAs

75. **The water quality.** The current raw water quality from Dahuofang Reservoir meets the Grade II of Surface Water Quality Standards (GB3838-2002). The average annual turbidity of raw water is 5NTU. The seasonal raw water quality mainly is low-temperature, ultra-stable water, high temperature with algae, and higher turbidity in flood season.

76. The treated water qualities from the WSPs meet the national Drinking Water Quality Standard (GB5749-2006). The average turbidity in pipe network is 1NTU, except during the flood seasons and other special periods. The water quality in new pipe network also meets the standard, but for some aged pipes, the water quality in network terminal does not meet the standards. After running the secondary water supply facilities, the water quality parameters in some residential communities, such as turbidity, color, iron all increased in comparison with those in the WSPs.

77. **The water distribution pipe network.** The total length of Fushun water supply pipe network is 2,176.41 km. The pipe types mainly include PE, gray cast iron, steel, PVC, and concrete pipes. The pipes constructed after 2013 are mainly DIP and PE pipes. In recent years, Fushun Water Supply Company replaced some aged pipes, but there are still a large number of pipes running over 30 years (accounts for 16.77%). The proportion of aged gray cast iron pipe, concrete pipe, and galvanized steel pipes together account for 50.64% of the total, the proportion of early PVC pipe accounts for 10.07%, which is the main reason for the water quality compliance rate lower than that in the WSPs, the low water quality compliance rate, high leakage and sometime pipe burst are the main problems for water supply safety. In addition, the coal-mining subsidence area in Fushun is 18.41 km^2, with sometimes mine earthquakes, caused the pipe leakage as high as 37.8%

78. **The secondary booster pumping stations.** There are 242 secondary boosting pump stations in Fushun, of which 90% are aged, resulting high energy consumption and frequent leakage accidents. The water tanks in nine stations are still being used, which easily cause secondary pollution. 197 stations have no monitoring, no fire alert, no data transmission, etc.

79. **Water Quality Monitoring capacity.** The national Drinking Water Quality Standards (GB5749-2006) was mandatorily implemented nationwide on July 1, 2012. The standard increases the drinking water quality parameters from 64 to 106. The current water quality monitoring capacity of the monitoring center under Fushun Water Supply Company is 76 parameters only; another 30 parameters cannot be monitored due to lack of instruments. The WSPs can only on-line detect turbidity and residual chlorine, for the secondary water supply, the on-line monitoring device is only installed in Qiandian booster pumping station for pipeline water quality monitoring. The monitoring capacity of the Water Supply Company needs to be much improved.

IV-4 Fuxin

80. Fuxin is located in the northwest of Liaoning Province, with the total area of 10,323 km^2 and the population of 1.9 million in 2015, including urban population of 770,000. The regional GDP was RMB 54.2 billion yuan in 2015.

(i) Natural environment

81. **Topography and Geology:** Fuxin is located in the transition zone between the Inner Mongolia Plateau and the Liaohe River Plain, and lies in the hilly and mountainous areas of western Liaoning. The mountainous areas are located in the west and southwest areas, while the hills are in the north and northwest, the plains are concentrated in Zhangwu County and southeast of Fumeng County. The project area is flat and wide, and the geomorphic unit is transitional type from the erosion quasi-plain to the alluvial plain. The lower layer is strong weathering Jurassic sedimentary sand shale, with stable geological structure and simple lithological structure.

82. **Weather:** Fuxin is located in the northern temperate zone, with typical continental monsoonal climate, with four clearly distinct seasons, cold winter and dry summer. the average temperatures is 8.7℃. the extreme maximum temperature and extremely minimum temperature were 37.5℃ and -23.0℃, respectively. The average annual precipitation is 457 mm, mostly occurring during July to September.

83. **Hydrology:** Xi River is the only river flowing through the Fuxin urban area, which originated in the west slope of Luotuo Hill in Fumeng County, flows through the Xinqiu, Fuxin County, Fuxin urban area, Dongliang, and Qinghemen, and finally flows into the Daling River in Yi County. The total length of river in Fuxin region is 86.2 km. the river is now the sewage body of Fuxin City, receive wastewaters from both nearby enterprises and residents. The main surface water sources in the city are Liu River, Yangximu River, Raoyang River and Xi River. The average annual water resource is 973.08 million m^3 including surface water of 503.9 million m^3 and groundwater of 606.4 million m^3.

(ii) Current status of construction site

84. The proposed Fuxin municipal pipeline constructions will be laid under the existing municipal roads (non-motorized lanes); while the residential courtyard pipe works will be laid under the residential community' path, small part of the pipes will pass through greenbelt within the residential yards, the path and grassland will be recovered after the pipes are constructed. The permanent land of the pump station project covers an area of 6.048 mu, of which, the state-owned land transfer with compensation of 3.024 mu, the land owns by the Development

Zone Government; the project also acquired construction land of 3.024 mu in Xinqiu District, the status quo of land is wasteland with vegetation coverage rate 60%.

(iii) Environmental baseline

85. **Ambient air:** According to the Monitoring Report of Ambient Air Quality of Fuxin City in 2015, the Ambient Air Quality and assessment result is shown in the Table IV-12.

Table IV-12 The Baseline of Ambient Air Quality (μg/m^3)

Pollutant	Data (Annual average)	Grade II Standard (annual average)	Standard exceed multiple
SO_2	52	60	0.87
NO_2	30	40	0.75
PM_{10}	101	70	1.44
$PM_{2.5}$	49	35	1.4

Source: the domestic EAs

86. The above data show that the average annual concentration of PM_{10} and $PM_{2.5}$ exceeded the Grade II ambient air quality standard of GB3095-2012, while the average annual concentration of SO_2 and NO_2 met the Grade II Standard. The main reason for the PM_{10} and $PM_{2.5}$ standards exceeding is fugitive dust caused by strong wind in spring.

87. **Surface water:** According to the "Monitoring Report of the Surface Water Quality in Fuxin City (2015)", in July and August 2015, the water quality of the Gaotaizi section of Xi River met the Class V surface water standard of GB3838-2002.

88. **Baseline of noise:** Noise monitoring was conducted at 12 points, comprising 4 at the boundaries of the WSP s (No.1-4), four at the boundaries of 10,000 m3/d pumping station, and the 4 points at the boundaries of 15,000 m3/d pumping station, respectively. Monitoring was conducted on two consecutive days from 26-27 July 2016 by Dalian Huaxin Physical and Chemical Testing Center. In accordance with PRC Acoustic Environmental Quality Standard (GB3096-2008), assessment areas for construction of WSP and pumping stations are classified as Class II. And the monitoring data show that all the baseline noise data met the standard.

Table IV-13 Noise Baseline at Naodehai WSP

Boundary / Date	1# East Boundary		2# South Boundary		3# West Boundary		4# North Boundary		Grade II Standard	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
2016.7.26	47.8	39.6	46.1	43.1	45.2	39.1	48.0	39.5	60	50
2016.7.27	47.8	39.6	47.4	43.7	47.1	42.4	46.5	43.8	60	50

Source: the domestic EAs

Table IV-14 Noise Baseline at the 10000 m3/d Pump Station (dB)

Boundary / Date	5# East Boundary		6# South Boundary		7# West Boundary		8# North Boundary		Grade II Standard	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
2016.7.26	50.4	39.6	50.7	42.3	52.4	43.8	50.0	42.5	60	50
2016.7.27	50.1	39.1	50.9	40.1	52.5	43.7	50.1	41.0	60	50

Source: the domestic EAs

Table IV-15 Noise Baseline at the 15000 m3/d Pump Station

Boundary / Date	9# East Boundary		10# South Boundary		11# West Boundary		12# North Boundary		Grade II Standard	
	Day	Night	Day	Night	Day	Day	Day	Night	Day	Night
2016.7.26	47.3	42.5	45.0	41.8	60	60	51.3	43.7	60	50
2016.7.27	45.9	43.0	46.2	42.6	60	60	53.6	43.5	60	50

Source: EA Report

(5) The situation of Fuxin water supply system

89. **Raw water sources and water supply amount.** The water sources of Fuxin city include three groundwater sources (Ling River, Wangfu, Daba) and three surface water sources (Naodehai Reservoir, Baishi Reservoir, and Fosi Reservoir), with the maximum water supply capacity of 350,000 m^3/d. In 2015, the highest water supply amount of urban area is 250,000 m^3/d, of which the surface water takes up 160,000 m^3/d (accounting for 64%), and the groundwater takes up 90,000 m^3/d (accounting for 36%). In order to protect local ecological environment, the four WSPs will have to be shut down except the WSPs of Naodehai and Baishi according to the plan. The raw water pipeline for the two WSPs is about 90 km, and the terrain that pipelines along is complex, and crosses several rivers. If raw water pipeline failure occurs, it will severely impact the water supply safety in the city.

90. **Fuxin Water Supply Company** is the only water supply enterprise in the City. Its water supply area is 78.3 km^2 and coverage rate of 98%, the length of water supply pipeline is 2197 km. The company is responsible for supply tap water to 1,600 enterprises and institutions, more than 20,000 industrial and commercial users, more than 0.34 million households (nearly 0.8 million residents). The total annual water supply amount is 73.36 million m^3.

91. The current water consumption per capita in Fuxin urban area is 0.11 m^3/d only, With the coal resource exhausted, Fuxin' accelerated industrial transformation and development, its water supply shortage gradually revealed. The water supply shortage seriously affects the economic development of the City and its residents' life.

92. Fuxin City's water supply system was founded in 1930s. Part of the water supply pipeline is aged with high leaking rate, especially in the old residential communities. The average leakage rate of pipe network in some old residential communities is up to 60%. In 2015 a year, the total amount of water leaking loss was as high as nearly 7.0 million m3 annually, which caused waste of water resources, energy consumption, and high cost of water supply. According to statistics, the domestic water supply cost is higher than the world average level. The cost of water supply in Liaoning Province is higher than the national average level. And Fuxin is the highest cost one in Liaoning province.

93. In 2015, the water quality compliance rates of treated water and in pipe were 99.7% and 99.51%, respectively. The main parameters exceeded the standards are turbidity (with the exceeded standard rate of 1.5%), residual chlorine (exceeded 0.41%), thermos-tolerant coliform (exceeded 0.20%). The reason for the exceeded standard are aged pipeline network and pipeline sediment, and the pipeline leakage, etc. there is no qualified water quality monitoring instruments to ensure accuracy of water quality monitoring. Nevertheless, due to shortage of investment, the project construction has not been fully completed.

94. The Naodehai WSP, use surface water as its raw water, is located in the eastern part of Fuxin City. Its design capacity is 100,000 m3/d, the actual maximum water production amount is 70,000 m3/day. The WSP was built in the early 1990s. Most equipment have been aged and malfunction. The interior walls of water purification chamber peel off seriously, which not only affects the appearance, but also may plug the process equipment, and impact the treated water quality. Most of old equipment need to be replaced under this project.

IV-5 Gaizhou

95. Gaizhou is located in the northwest of Liadong Peninsula, 212 km south of Shenyang, with the total area of 2,930 km^2 and the population of 720,000 in 2015. The regional GDP was RMB 9.84 billion yuan in 2015.

(i) Natural environment

96. **Geology and Geomorphology:** The landform of Gaizhou city is hilly area of southern Liaoning. Its eastern and southeastern low mountains and hills are the extension of Qianshan geographical position, and its west and northwest areas are the plain, which form the ladder landform of the east high and west low. The western coastal area is 5 m ASL, the lowest point of the city; and the average elevation of plain area is 19m ASL, while the hilly area is 48m ASL, and the low mountain area is 170m ASL. The Buyunshan Mountain located at the junction of Luotun Township and Zhuanghe County is 1,130m ASL, the highest point in southern Liaoning.

97. The proposed project site is located at hilly area of eastern Liaoning Province, with elevation around 35-31m generally. According to the 2001 edition of " Seismic Ground Motion Earthquake Acceleration Map of China " (GB18306-2001), the ground motion peak acceleration is 0.30g, the characteristic period of ground motion response spectrum is 0.65s, and the corresponding earthquake basic intensity is 7 degrees.

98. **Climate:** Gaizhou belongs to the warm temperate continental monsoon climate, with four distinct seasons. The annual average temperatures is 9.5℃, the extreme maximum temperature and extremely minimum temperature were 35.6℃ and -27.0℃, respectively. The average annual precipitation is 670-830 mm, mostly occurring during July to September.

99. **Hydrology and water resources:** There are five rivers of Daliao, Daqing, Biliu and Xiongyue in Gaizhou City. The Daqing River runs through the urban area, with the average annual flow of 127.89 million m^3 within Gaizhou. The seasonal runoff of Daqing River is concentrated from June to September (accounting for 82.3% of total annual flow). The average annual water resource of the city is 141.75 million m^3 including surface water of 131.03 million m^3 and utilizable groundwater of 11.72 million m^3.

(ii) Current status of construction site

100. The treated water pipeline will be laid along the east of 202 Highway, it will temporarily covers an area of 84 mu, including the construction land 17.1 mu, dry field of 18.263 mu, orchard of 48.637 mu (it needs to take up the existing road surface of 202 Highway 150 m x 10 m near Tashan WSP).

(iii) Environmental baseline

101. **Ambient air:** Ambient air quality monitoring was conducted for seven consecutive days from 25-31 August 2016 by the Gaizhou Environmental Monitoring Station (EMS). Three monitoring points were selected, No.1 Tieta Village – 150m east of the main water supply pipeline; No.2 Dongbaling Village – 200m southwest of the WSP; and the No.3 Jijia Village – 180 m north of the raw water transmission pipeline. Four parameters were monitored (Table 4-8). The applicable standard here is Grades II Ambient Air Quality Standard. The monitoring results are shown in Table IV-16 and IV-17.

Table IV-16 Baseline of Ambient Air Quality

Pollutant		TSP			PM_{10}		
Monitoring point		No1. Tieta Village	No.2 Dongbaling Village	No.3 Jijia Village	No1. Tieta Village	No.2 Dongbaling Village	No.3 Jijia Village
Range of concentration（μg/m^3）		182~200	186~202	180~194	82~94	108~118	84~94
Max Value（μg/m^3）		200	202	194	94	118	94
Daily average value (μg/m^3)	2016.8.25	186	198	182	90	116	94
	2016.8.26	200	186	192	94	114	92
	2016.8.27	192	208	188	88	112	90
	2016.8.28	190	198	188	90	112	90
	2016.8.29	190	202	194	94	118	92
	2016.8.30	182	194	180	82	108	84
	2016.8.31	194	208	192	92	114	92
Standard Value		300			150		

Source: the domestic EAs

Table IV-17 Ambient Air Quality Status

Pollutant		SO_2			NO_2		
Monitoring point		No1. Tieta Village	No.2 Dongbaling Village	No.3 Jijia Village	No1. Tieta Village	No.2 Dongbaling Village	No.3 Jijia Village
Max Value（μg/m^3）		2	2	2	22	26	24
Daily Average value (μg/m^3)	2016.8.25	2	2	2	18	20	18
	2016.8.26	2	2	2	20	22	18
	2016.8.27	2	2	2	18	20	18
	2016.8.28	2	2	2	22	26	20
	2016.8.29	2	2	2	22	26	24
	2016.8.30	2	2	2	16	20	18
	2016.8.31	2	2	2	18	20	18
Standard Value		150			80		

Source: the domestic EAs

102. The monitoring result shows that the average daily concentration of TSP, PM10, SO2 andNO2 all met the Grade II standard of GB3095-2012.

103. **Noise:** Noise monitoring was conducted by Gaizhou EMS at 7 points, comprising 4 at the boundaries of the WSP, and three villages near the WSP, respectively. Monitoring was conducted on two consecutive days from 25–26 August 2016. The applicable standard for the noise impact areas are Grade II and Grade IV of sound environmental quality standard (GB3096-2008). The monitoring results are shown in Table IV-18.

Table IV-18 Baseline of Noise (Gaizhou)

Monitoring Point / Monitoring date		East boundary	South boundary	West boundary	North Boundary	Mentun Village	Dongbaling Village	Guanjiadian Village
25 Aug. 2016	Day	48.9	47.2	48.5	50.1	68.5	67.6	68.0
	Night	40.4	39.2	40.0	41.7	52.1	46.2	47.1
26 Aug. 2016	Day	48.4	46.5	48.9	49.6	67.8	66.9	67.1
	Night	40.0	38.4	40.5	41.2	51.4	45.8	46.3
Standard Value	Day	60	60	60	60	70	70	70
	Night	50	50	50	50	55	55	55

Source: the domestic EAs

104. From the table above, the noise value during the daytime and night at the four boundaries of the Dongbaling WTP, and the nearby Villages of Mentun, Dongbaling and Guanjiadian met the Grade II or Grade IV Standard of GB3096-2008.

(iv) The situation of Gaizhou Water Supply System

105. Gaizhou urban water supply area is divided into three zones, Hebei District, Henan District (including the east new district) and Beihai New District. At present there are two groundwater WSPs, with the designed capacity of 65,000m^3/d, and the actual water supply amount of 40,000m^3/d.

106. Tashan WSP, located at the foot of Tashan Mountain, was built in 1990. The WSP, with the total area of 0.99ha, takes water from 6 deep wells along the north riverside of Daqing River. The water supply capacity is 15,000m^3/d. The length of water transmission pipeline (DN400) is 3 km. The water treatment process includes groundwater taking and chlorinated disinfection. Due to urban development, the water supply capacity is planned to expand to 45,000m^3/d.

107. Henan WSP, located in Daqing River Economic Development District, was built in 2004, with the total area of 1.2ha. The water supply capacity is 20,000m^3/d. The treatment process is groundwater taking from wells and chlorinated disinfection.

108. The water distribution pipeline of Hebei District in Gaizhou City was constructed in 1972, with the total length of 42 km (DN100-DN600). Most of pipes were constructed in 1972, together with the Tashan WSP, but some pipes for the old residential communities were constructed even in 1950s-1960s, with high leakage rate.

109. The distribution pipeline of Henan District, constructed together with the Henan WSP, is generally in good condition. The distribution network (DN200-DN800) with the total length of 24.9km, for the East District and Beihai New District, is under construction, after the construction, the total length of water distribution pipe in the city will be 67 km.

110. At present, the water supply networks in the newly built residential communities are relatively completed, but those within the old residential communities, due to aged pipes, the water leakage is high, and with potential secondary water quality contamination. There are no partitioned metering neither pipeline flow monitoring device in some low water pressure areas and semi-urban areas. In some areas, even water bills are charged by number of people or household, not by actual water consumption. There is no intelligent water supply and pipeline system in the city.

IV-6 Environment Protection Objectives within Project Area of Influence in five Project Cities

111. Based on the characteristics of the proposed project components/subprojects, the environmental features of the sites and inspection by the EA Institutes, the sensitive receivers within the projects' area of influence in the five project cities have been identified, which are listed in Table IV-19 to Table IV-23 below.

112. The environmental impact factors for the project environmental protection objectives are all dust, noise and construction safety. The applicable environmental standard is Class II in Ambient Air Quality Standard (GB3095-2012) and Class 1, 2 and 4a in Acoustic Environment Quality Standard (GB3096-2008). In addition to the Christianity Church in Shenyang, the project doesn't involve water source protection zone, nature reserve zone and scenic spots and other sensitive areas except one Catholic church in Shenyang.

(1) Environment Protection Objectives for Shenyang Project

113. The main constructions of Shenyang Project are pipeline works, the related environment protection objectives are residential communities, schools, hospitals, and kindergartens, etc. along the pipeline routes. The major impacts during the construction are dust, noise, traffic congestion and safety, etc. the constructions involve 5 railway crossings and 8 river crossings (Table 7-8). For reducing the impacts to the river environment and railway transportation, the trenchless technologies (pipe-jacking and pipe–pulling) will be adopted, which are environmentally friendly technologies with only small amount of slurry and surplus earth impact.

114. Shenyang Nanguan Catholic Church was built in 1878, which was destroyed by fire in 1900. The existing structure was rebuilt in 1912. The total area of church is 1100 m^2 (66m in south to north direction, and 17m in west to east direction), with the height of 40m. The church was named as municipal heritage conservation unit by Shenyang Municipal Government in February 1985, while named as the provincial heritage conservation unit by Liaoning Provincial Government in December 1988. The church is the catholic community center in Shenyang and the northeast area of China. Currently, the numbers of catholic believers participating the weekly Mass are about 2000. The nearest distance between the construction site and the protection boundary of Church (30m out of the Church wall) is about 180m. The construction will not occupy (including temporary occupying) any area within the protection range.

Table IV-19 Environmental Protection Objectives - Shenyang

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
Boundary Newly Build 1	Jianshe Xi Road	Newly Build	729.4	Yangguang Wutongyuan	Residential	12	210	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
				Baishun Yuan	Residential	25	-		
				Luer Xintiandi	Residential	23	-		
Boundary Newly Build 2	Zhaogong Bei Road	Newly Build	2389.89	Hengda Huafu	Residential	10	189		
				Langrun Yuan	Residential	13	864		
				Fangda Shengjing	Residential	10	72		
				Yujingting	Residential	18	26		
				Meihao Yuanjing	Residential	13	180		
				Lvxiajueshi Yijing	Residential	1	96		
Boundary Newly Build 3	Beiyi Road	Newly Build	1118.83	Unknown Community	Residential	1	448		
				Pass through Railway at 1 location	Abandoned	Crossing length of 6m (trenchless construction)		Small amounts of slurry and surplus earth	-
Boundary Rehabilitation 1	Jianshe Zhong Road	Rehabilitation	690.16	Xinxin Jiayuan	Residential	5	288	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ;
				Hongwei Jindu	Residential	6	-		
				Qianyuan Aiyucheng	Residenti	23	-		

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
					al				Class II in Acoustic Environment Quality Standard (GB3096-2008)
Boundary Rehabilitation 2	Nan No.11 Road	Rehabilitation	419.52	Mingze Yuan	Residential	8	110		
				Unknown Community 1	Residential	8	45		
				Unknown Community 2	Residential		60		
				Fuhai Yuntian	Residential	5	183		
				Pass through river at 1 location	Weigong Canal, sewage outlet river	Crossing length of 22m (trenchless construction)		Small amounts of slurry and surplus earth	Water quality of Class V in Surface Water Environmental Quality Standard (GB3838-2002)
Boundary Rehabilitation 3	Nan Shiyi Xi Road	Rehabilitation	1378.88	Yingbin Hauyuan and etc.	Residential	5	1200	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
				Yuhong Zhongxin Primary school	Primary school	5	One teaching building		
Boundary Rehabilitation 4	Nan Shier Zhong Road	Rehabilitation	708	Fuhai Yuntian	Residential	5	308		
				Shicheng Huayuan	Residential	18	397		
				Pass through river at 1 location	Weigong Canal, sewage outlet river	Crossing length of 34m (trenchless construction)		Small amounts of slurry and surplus earth	Water quality of Class V in Surface Water Environmental Quality Standard (GB3838-2002)
Boundary Rehabilitation 5	Xinghua Bei Street	Rehabilitation	235.49	Xinhu Mingzhu I	Residential	171	18	Dust, noise and construction	Class II in Ambient Air Quality Standard
				Xinhu Mingzhu II	Residenti	18	640		

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
					al			safety	(GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
				Xinfeng Yongjinghaocheng	Residential	2	-		
Internal Rehabilitation 1	Weigong Street	Rehabilitation	5200	Tiexiqu Huimin Hospital	Community hospital	6	40 hospital bed		
				Diyicheng and etc.	Residential	6	1800		
Boundary Rehabilitation 9	Tawan Street	Rehabilitation	1136.91	Zhonghai Square	Residential	25	-		
				Xin Hancheng	Residential	25	-		
				Tawan Community	Residential	2	-		
				Zhonghai Huanyutianxia	Residential	16	180		
Boundary Rehabilitation 10	Yaoshan Road	Rehabilitation	123.78	Huanggu Bayuan	Community hospital	8	38 hospital bed		
				Unknown Community	Residential	8	580		
				Huatai Xindu	Residential	22	-		
				Fanglin Jiayuan	Residential	16	108		
Boundary Rehabilitation 11	Songhuajiang Street	Rehabilitation	316.74	Baijiang Primary school	Primary school	14	One teaching building		
				Residential Along	Residential	10	40		
Boundary Rehabilitation 12	Zhujiang Street	Rehabilitation	1326.56	Pass through railway at 1 location	In operation	Crossing length of 30m		Construction safety	-
				Residential along	Residential	5	1200	Dust, noise and construction	Class II in Ambient Air Quality Standard
Internal	Jinshajiang	Rehabil	1000	Shenyang No.134 Middle	Middle	6	Two		

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
Rehabilitation 13	Street	itation		School	School		teaching buildings	safety	(GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
				Zhujiang No.5 School	Primary school	4	One teaching building		
				Shenyang No.120 Middle School	Middle School	7	Two teaching building		
				Fangxin Yuan	Residential	4	360	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
Internal Rehabilitation 14	Bashan Road	Rehabilitation	950	Liaohe Residential Community and etc.	Residential	4	650		
Internal Rehabilitation 15	Foshan Road	Rehabilitation	950	Gelin Xiameng and etc.	Residential	3	6800		
Internal Rehabilitation 16	Daoyi Bei Street	Rehabilitation	1 50	Taifengyuan etc	Residential	12	20		
Internal Rehabilitation 17	Huanghe Bei Street	Rehabilitation	1620	Shengyang Normal University etc	University	25	-		
Internal Rehabilitation 18	Daoyi Bei Street	Rehabilitation	6960	Shengyang Normal University, Liaoning University, Shenyang Hangkonghangtian University	University	25	-		
Internal Newly Build 5	Wenda Road	Newly Build	50 0	Rongsheng Yuan etc	Residential	20	1200		
Internal Newly Build 6	Taiyueshan Road	Newly Build	900	Tawanxiao	Primary school	8	Three teaching buildings		

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
Internal Newly Build 7	Yinshan Road	Newly Build	1500	Fuliyangguang etc	Residential	12	800		
Internal Newly Build 8	Yalujiang Street	Newly Build	4500	Pass through railway at 1 location	Abandoned	Crossing length of 6m (trenchless construction)		Small amounts of slurry and surplus earth	-
Internal Newly Build 9	Xianglusha n Road	Newly Build	1000	Wankesiji Huacheng and etc	Residential	10	1600	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
Internal Newly Build 10	Huishan Xi Road	Newly Build	1500	Baodao Community	Residential	10	1200		
Internal Newly Build 11	Wenda Road	Newly Build	5860	Wanfang Lvye etc	Residential	8	80		
Internal Newly Build 12	Xijiang Bei Street	Newly Build	2800	Pass through river at 1 location	Unknown river	Crossing length of 6m (trenchless construction)		Small amounts of slurry and surplus earth	-
				Zaohua Primary school	Primary school	-	-	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
				Bolin xiandaicheng etc	Residential	16	400		
Internal Rehabilitation 19	Daoyi Bei Street	Rehabilitation	5920	Baile Community etc	Residential	8	60		
				Pass through river at 1 location	Pu River, Class V waterbody	Crossing length of 35m (trenchless construction)		Small amounts of slurry and surplus earth	Water quality of Class V in Surface Water Environmental Quality Standard

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
									(GB3838-2002)
Internal Rehabilitation 20	Hushitai Street	Rehabilitation	21640	Xinning Jiayuan etc	Residential	40	-	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
Internal Rehabilitation 21	Jianshe Beier Road	Rehabilitation	2000	Chanye Xingu etc	Residential	8	1600		
Internal Rehabilitation 22	Bangjiang Street	Rehabilitation	1700	Shenyang Zhendong Middle School	Middle School	21	-		
				Shenyang No.107 Middle School	Middle School	7	One teaching building		
				Chengjian Donghuayuan etc	Residential	7	900		
Internal Rehabilitation 23	Xindong Er Street	Rehabilitation	600	Zhujing Xinguang etc	Residential	5	2200		
Internal Rehabilitation 24	Daguan Bei Street	Rehabilitation	1000	Shenyang No. 5 Middle School	Middle School	14	Two teaching buildings		
				Shengning Yuan etc	Residential	14	2200		
Internal Rehabilitation 25	Xiaoheyan Road	Rehabilitation	500	Liaoning Provincial Tumour Hospital	Hospital	8	One outpatient building		
				Jiefangjun No. 463 Hospital	Hospital	10	-		
Internal Rehabilitation 26	Shanlin Road	Rehabilitation	700	Yubeiyi Community	Residential	8	360		
Boundary Rehabilitation 7	Dashizi Street	Rehabilitation	529.1	Jingmei Primary school	Primary school	6	-		
				Unknown residential building	Residential	9	480		

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
Boundary Rehabilitation 8	Zhulin Road	Rehabilitation	1898.31	Unknown residential building	Residential	7	450		
Internal Rehabilitation 3	Nanyanghu Street	Rehabilitation	2500	Yutai Community	Residential	18	220		
				Pass through river at 1 location; Xi River, Class V waterbody	Crossing length of 6m (trenchless construction)			Small amounts of slurry and surplus earth	Water quality of Class V in Surface Water Environmental Quality Standard (GB3838-2002)
Internal Rehabilitation 31	Xihenan Road	Rehabilitation	1100	Unknown Community	Residential	16	660	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
Boundary Rehabilitation 13	Fushun Road	Rehabilitation	762.17	Residential along	Residential	5	2200		
Boundary Rehabilitation 14	Shisiwei Road	Rehabilitation	263.61	Japanese Consulate	Consulate	3	-		
				USA Consulate		3	-		
				Residential along	Residential	3	390		
Boundary Rehabilitation 15	Harbin Road	Rehabilitation	762.23	Old Beizhan Xi Community etc.	Residential	6	1900		
Boundary Rehabilitation 16	Bawei Road	Rehabilitation	787.1	Shenyang NO. 126 Middle School	Middle School	3	One teaching building		
				Jinhua Community etc	Residential	4	1600		
Internal Rehabilitation 4	Zhongxing Street	Rehabilitation	1000	Dianye Community, Tiesha Community etc.	Residential	-	2500	Dust, noise and construction safety	Class II in Ambient Air Quality Standard
Internal	Jiaxing	Rehabil	800	Zhenxing No.2 School	Primary	3	-		

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
Rehabilitation 5	Street	itation			school				(GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
				Wanlicheng etc	Residential	3	2400		
Internal Rehabilitation 6	Shashan Street	Rehabilitation	900	Meigui Gongguan etc	Residential	3	2700		
Internal Rehabilitation 7	Wulihe Street	Rehabilitation	460	Changxin Community, Wanke Zijinyuan etc	Residential	5	2200		
Internal Rehabilitation 8	Ningbo Road	Rehabilitation	880	Yicong Huayuan etc.	Residential	13	820		
Internal Rehabilitation 9	Wanshousi Street	Rehabilitation	450	Baoshi Jiayuan etc	Residential	3	1100		
Internal Rehabilitation 10	Wanshousi Street	Rehabilitation	200	Chenguang Community etc.	Residential	2	460		
Internal Rehabilitation 11	Fengtian Street	Rehabilitation	1700	Shenyang Communist Youth League Middle School	Middle School	8	One teaching building		
				Shenyang Experimental Middle School	Middle School	8	One teaching building		
				Shenhe No.8 Hospital	Community hospital	8	38 hospital beds		
				Shenyang No.7 Middle School	Middle School	8	-		
				Maoquan Community etc.	Residential	6	1300		
Internal Rehabilitati	Nanyijing Street	Rehabilitation	960	Dianye Community, Xingsheng Community etc	Residential	3	480		

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
on 12									
Internal Newly Build 1	Taiyuan Nan Street	Newly Build	680	Unknown Community etc	Residential	4	1300		
Internal Newly Build 2	Heping Nan Street	Newly Build	600	Baihe Yuan etc.	Residential	14	800		
				Pass through river at 1 location: Nanyun River, Class V waterbody	Crossing length of 50m (trenchless construction)			Small amounts of slurry and surplus earth	
Internal Newly Build 3	Wenti Xi Road	Newly Build	2200	Lvjing Jiayuan etc.	Residential	6	900	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
Internal Newly Build 4	Sha Street	Newly Build	1180	Sanli Hepingwan etc.	Residential	8	1600		
Boundary Rehabilitation 17	Xishuncheng Street	Rehabilitation	321.29	Taoyuan Community etc.	Residential	3	800		
				Nanguan Catholic Church	Religious institution	45 staff, the distance between the construction site to the protection boundary is 180m.	2,000	Traffic congestion and safety	
Internal Newly Build 17	Quanyuan Yi Road	Newly Build	400	Quanyuan Community etc.	Residential	6	400		

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
Internal Newly Build 18	Jiangdong Street	Newly Build	2500	Jiangdong Community etc	Residential	6	400		
Internal Newly Build 19	Fangling Road	Newly Build	1120	Unknown Community	Residential	5	600		
Internal Newly Build 20	Dongxin Road	Newly Build	2100	Baoli Huayuan etc	Residential	5	2000		
				Pass through railway at 1 location	Abandoned	Crossing length of 6m (trenchless construction)		Small amounts of slurry and surplus earth	-
				Pass through river at 1 location	Huishan Canal, pollution receiving river	Crossing length of 15m (trenchless construction)		Small amounts of slurry and surplus earth	
Internal Rehabilitation 29	Fumin Street	Rehabilitation	1600	Shenyang No. 51 Middle School	Middle School	22	-	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
				Fuminyuan etc	Residential	6	1200	Dust, noise and construction safety	
Internal Newly Build 13	Guihua Street	Newly Build	1150	Shenyang No. 30 Middle School	Middle School	5	One teaching building		
				Qingsong Middle School	Middle School	18	One teaching building		
				Jinbao Huayuan etc.	Residential	12	900		

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
Internal Newly Build 14	Yingchun Street	Newly Build	2500	Pass through river at 1 location	Shenfu Canal, Class V waterbody	Crossing length of 40m (trenchless construction)		Small amounts of slurry and surplus earth	
				Haitang Huayuan	Residential	8	400	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
Internal Newly Build 15	Dingchun Street	Newly Build	2200	Biguiyuan Fenghuangcheng etc	Residential	20	800		
				Pass through river at 1 location	Shenfu Canal, Class V waterbody	Crossing length of 40m (trenchless construction)		Small amounts of slurry and surplus earth	Water quality of Class V in Surface Water Environmental Quality Standard (GB3838-2002)
Internal Newly Build 16	Yingchun Bei Street	Newly Build	3500	Xiushui Huacheng etc	Residential	15	600	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
				Pass through railway at 1 location	In use	Crossing length of 6m (trenchless construction)		Small amounts of slurry and surplus earth	-
				Pass through river at 1	Hunan	Crossing length of		Small	

Construction Item				Sensitive Objective				Environmental Impact Factor	Applicable Standard
Item	Location	Construction Type	Length(m)	Environmental Protection Objective	Character of Protection Objective	Distance to Site	Affected Household/ Scale		
				location	Canal, Class V waterbody	15m (trenchless construction)		amounts of slurry and surplus earth	
Internal Rehabilitation 28	Qiaosong Road	Rehabilitation	3500	Xiushui Huacheng	Residential	5	200	Dust, noise and construction safety	Class II in Ambient Air Quality Standard (GB3095-2012)；Class II in Acoustic Environment Quality Standard (GB3096-2008)

Source: the domestic EA

(2) Environment Protection Objectives for Anshan Project

Table IV-20 Environmental Protection Objectives – Anshan

Objective	Location/ Distance	Affected Household/Person	Environmental Impact Factor	Applicable Standard
1)Environmental Protection Objective for Tanghe River Pump Station				
Xiaodaogou Village	North/6m	53 Households/212 Person	Noise, construction safety	Grade II in Ambient Air Quality Standard；Class I in Acoustic Environment Quality Standard
	West/27m	62 Households/248 Person		
Tanghe River	North/186m	—	COD, Ammonia Nitrogen and etc.	Class II in Surface Water Quality Standard
2)**Environmental Protection Objective for Wangjiayu Water Plant**				
Zhongye YuluanwanCommunity	East/42.8m	692 Households/2076	dust, noise, construction safety, noise	Grade II in Ambient Air Quality Standard (GB3095-2012)；Class II in Acoustic Environment Quality

		Person	during operation	Standard (GB3096-2008)
Hainuo Shoufu Community	West/10.5m	906 Households/2718 Person		
Planning Community	North/5m	80 Households/240 Person		
Wanshuihe River	South/4200m	—	COD, Ammonia Nitrogen and etc.	Class IV in Surface Water Quality Standard (GB3838-2002)

3) Environmental Protection Objective for Booster Pump Station

Pump Station	Environmental Protection Objective	Location/ Distance (m)	Affected Household/Person	Environmental Impact Factor	Protection Requirement
10# Gaoxin Pump Station	Xiangwan Padiou Community	North/13m	1260 Households/3780 Person	dust, noise, construction safety, noise during operation	Grade II in Ambient Air Quality Standard (GB3095-2012) ; Class I in Acoustic Environment Quality Standard (GB3096-2008)
	Yanhai Zhihui Community in Construction	North/5m	1020 Households/3060 Person		
22# Hongtaigou Pump Station	Hongtaigou Residential Area	North/26m	3 Households/12 Person		
		West/7m	3 Households/12 Person		
		South/7m	15 Households/60 Person		
80# Huanjian Pump Station	Taohuayuanju Community	East/17m	594 Households/1782 Person		
	North Residential Area	North/11m	216 Households/648 Person		
13# Shengousi No. 6 Area Pump Station	Shengousi No. 6 Residential Area	East/6m	468 Households/1404 Person		
		South/9m	36 Households/108 Person		
		North/13m	234 Households/702 Person		
16# Shengousi No. 7 Area Pump Station	Shengousi No. 7 Area Residential Area 区	South/8m	432 Households/1296 Person		
18# Dongshanfengjing Pump Station	Dongshanfengjing Community	North/10m	540 Households/1620 Person		

8# Lvzhiyuan Pump Station	Lvzhiyuan Community	North/8m	432 Households/1296 Person		
		South/12m	144 Households/432 Person		
1# Shengousi No. 2 Area Pump Station	Zhengyang Residential Area	East/8m	72 Households/216 Person		
		West/10m	72 Households/216 Person		
		North/5m	468 Households/1404 Person		
49# Ping'an Community Pump Station (Shengchan Street)	Wanxiang huachuang Community	South/9m	192 Households/576 Person		
		North/8m	270 Households/810 Person		
9# Beichukou Pump Station	Beixing Fuyuan Residential Area	South/7m	468 Households/1404 Person		
		North/7m	216 Households/648 Person		
7# Qixiangtai Pump Station	Residential Area Nearby	East/13m	162 Households/486 Person		
		South/10m	324 Households/972 Person		
		West/1m	27 Households/81 Person		
12# Bajiazi Pump Station	Guohuai Residential Area	East/12m	144 Households/432 Person		Grade II in Ambient Air Quality Standard (GB3095-2012) ; Class II in Acoustic Environment Quality Standard (GB3096-2008)
		West/13m	108 Households/324 Person		
		North/14m	216 Households/648 Person		
2# Changzheng Pump Station	Residential Area near Pump Station	East/12m	216 Households/648 Person		
		South/9m	216 Households/648 Person		
		North/7m	108 Households/324 Person		

Source: the domestic EA

(3) Environment Protection Objectives for Fushun Project

Table IV-21Sensitive Receptors and Protection Objectives – Fushun

Environment Protection Objective	Distance from the Construction Site（m）	Affected Household
Xingyuan Community	50 m within pipeline reconstruction	690
Qixiangzhan Bungalow	50 m within pipeline reconstruction	35
Songjianglu Residence	50 m within pipeline reconstruction	383
Pijiuchang Residence	50 m within pipeline reconstruction	303
Yixi Community	50 m within pipeline reconstruction	1763
Jinglun Community	50 m within pipeline reconstruction	3183
Erfang Residence	50 m within pipeline reconstruction	726
Wumanyi Residence	50 m within pipeline reconstruction	1856
Bei'Anlu Community	50 m within pipeline reconstruction	1305
Liudonglou Community	50 m within pipeline reconstruction	1913
Dongzhou Avenue Residence	50 m within pipeline reconstruction	1746
Zuran Bungalow	50 m within pipeline reconstruction	167
Tian Community II & Sanyuan Residence	50 m within pipeline reconstruction	375
East of Yilan Street	50 m within pipeline reconstruction	92
Jinqiu Community	50 m within pipeline reconstruction	408
Ajingou Community	50 m within pipeline reconstruction	3011
Ajingou South	50 m within pipeline reconstruction	1633
Dalian Railway Residence	50 m within pipeline reconstruction	300
Dawan Bungalow	50 m within pipeline reconstruction	28
Dalian Bungalow	50 m within pipeline reconstruction	94
Dawan Pumproom South Residence	50 m within pipeline reconstruction	916
Dalian Community Residence	50 m within pipeline reconstruction	3692
Dalian Community West Bungalow	50 m within pipeline reconstruction	24
Kuangqian Community	50 m within pipeline reconstruction	1565
Shidonglou Community	50 m within pipeline reconstruction	2722
Dongshan Community	50 m within pipeline reconstruction	450
Bolichang Bungalow	50 m within pipeline reconstruction	230

Environment Protection Objective	Distance from the Construction Site（m）	Affected Household
Dongshanhuan Community	50 m within pipeline reconstruction	285
Zhangdang No.1 School Bungalow	50 m within pipeline reconstruction	47
Hydrologic Station Bungalow	50 m within pipeline reconstruction	50
Beilong Mechanical Residence	50 m within pipeline reconstruction	1609
Jiedusuo Bungalow	50 m within pipeline reconstruction	110
Dianganchang Bungalow	50 m within pipeline reconstruction	72
Firefighter Residence	50 m within pipeline reconstruction	20
Taipinggou Residence	50 m within pipeline reconstruction	540
East 5 Road Residence	50 m within pipeline reconstruction	976
Xintun No.2 Japen Building	50 m within pipeline reconstruction	757
Meidulu North Community	50 m within pipeline reconstruction	1052
Langshi Bungalow	50 m within pipeline reconstruction	524
Hexi Community	50 m within pipeline reconstruction	922
Langshi Residence	50 m within pipeline reconstruction	258
Sushi Building	50 m within pipeline reconstruction	719
Xintun No.11 Factory Residence	50 m within pipeline reconstruction	204
Huanli Bungalow	50 m within pipeline reconstruction	167
Jianshe Community	50 m within pipeline reconstruction	1845
Naihuo Community	50 m within pipeline reconstruction	560
Fenghua Community	50 m within pipeline reconstruction	1937
Tieling Community	50 m within pipeline reconstruction	1503
Xingang Community	50 m within pipeline reconstruction	1270
Youyuan Community	50 m within pipeline reconstruction	1424
Meiyan Community	50 m within pipeline reconstruction	1091
Changtu Community	50 m within pipeline reconstruction	1493
Heshun Community	50 m within pipeline reconstruction	1424
Benxi Community	50 m within pipeline reconstruction	793
Xifeng Community	50 m within pipeline reconstruction	153
Meiyan West Community	50 m within pipeline reconstruction	1679
Changsheng Community	50 m within pipeline reconstruction	2566

Environment Protection Objective	Distance from the Construction Site（m）	Affected Household
Wanzhong Community	50 m within pipeline reconstruction	1584
Bawei Road Community	50 m within pipeline reconstruction	798
Sanbao Community	50 m within pipeline reconstruction	542
Hongxing Community	50 m within pipeline reconstruction	2464
Xingguang Community	50 m within pipeline reconstruction	694
Liaozhong Community	50 m within pipeline reconstruction	4568
Danbei Community	50 m within pipeline reconstruction	1746
Dengta Community	50 m within pipeline reconstruction	1876
Youyan Community	50 m within pipeline reconstruction	896
Tai'An Community	50 m within pipeline reconstruction	2078
Liaoyang Community	50 m within pipeline reconstruction	1390
Gutian Community	50 m within pipeline reconstruction	2017
Tiancheng Community	50 m within pipeline reconstruction	4057
Tingtao Yanyuan	50 m within pipeline reconstruction	1420
Yanwu Community	50 m within pipeline reconstruction	1232
Yousan Community	50 m within pipeline reconstruction	2397
Nanyi Community	50 m within pipeline reconstruction	1053
Kaiyuan Community	50 m within pipeline reconstruction	3334
Jinzhou Community	50 m within pipeline reconstruction	1458
Jixiu Community	50 m within pipeline reconstruction	737
Jianxin Community	50 m within pipeline reconstruction	1955
Xinhe Community	50 m within pipeline reconstruction	1671
Jiayuan Community	50 m within pipeline reconstruction	1055
Lantian Shui'An	50 m within pipeline reconstruction	801
Leyuan Community	50 m within pipeline reconstruction	1236
Gaiping Community	50 m within pipeline reconstruction	800
Chenguang Community	50 m within pipeline reconstruction	344
Jialonglin	50 m within pipeline reconstruction	129
Xinyu Community	50 m within pipeline reconstruction	161
Jun'An Community	50 m within pipeline reconstruction	716

Environment Protection Objective	Distance from the Construction Site（m）	Affected Household
Xin Tiande	50 m within pipeline reconstruction	397
Jinshun Community	50 m within pipeline reconstruction	670
Lao Tiande	50 m within pipeline reconstruction	327
Zhongxin Community	50 m within pipeline reconstruction	242
Fuwan Fuwan	50 m within pipeline reconstruction	267
Wankelong	50 m within pipeline reconstruction	232
Heping Xinyuan	50 m within pipeline reconstruction	139
Gaoxing Yuan	50 m within pipeline reconstruction	124
Zonghe Building	50 m within pipeline reconstruction	101
Jindi	50 m within pipeline reconstruction	400
Guohua Community	50 m within pipeline reconstruction	1077
Huacheng II	50 m within pipeline reconstruction	483
Rixin	50 m within pipeline reconstruction	365
Huacheng I	50 m within pipeline reconstruction	749
Anyi Yaju	50 m within pipeline reconstruction	252
Bishui Jiayuan	50 m within pipeline reconstruction	193
Liwan Community	50 m within pipeline reconstruction	577
Honggang Community	50 m within pipeline reconstruction	1464
Jinwan Yaju	50 m within pipeline reconstruction	407
Mingde Community	50 m within pipeline reconstruction	895
Gaoli Jiayuan	50 m within pipeline reconstruction	442
No.4 Grain Depot	50 m within pipeline reconstruction	132
Petroleum No. 1 Factory	50 m within pipeline reconstruction	34
Xige Village	50 m within pipeline reconstruction	635
Gongnong Bungalow	50 m within pipeline reconstruction	144
Lvchang Bungalow	50 m within pipeline reconstruction	66
Fu Mine No.1 Company	50 m within pipeline reconstruction	431
Huiyuan Jiaju II	50 m within pipeline reconstruction	360
Huiyuan Jiaju III	50 m within pipeline reconstruction	695
Neighborhood Around Coal Preparation Plant Office Room	50 m within pipeline reconstruction	15

Environment Protection Objective	Distance from the Construction Site（m）	Affected Household
Hutai Street North Residence	50 m within pipeline reconstruction	720
Wanxin Quadrangle Dwellings	50 m within pipeline reconstruction	674
Huwan Road Community	50 m within pipeline reconstruction	926
Neighborhood of Grain Management Agency	50 m within pipeline reconstruction	32
Lizigou No 7-10 Building	50 m within pipeline reconstruction	432
Huoyaoku No. 27 Building	50 m within pipeline reconstruction	1215
Qiantai Mountain	50 m within pipeline reconstruction	2806
Pannan Road Nanhuayuan West Street- Nanhuayuan Central Street	50 m within pipeline reconstruction	3240
North of Nanchang Road	50 m within pipeline reconstruction	
Huangji Gou	50 m within pipeline reconstruction	45
Neigborhood of Qiantaishan Primary School	50 m within pipeline reconstruction	27
Neigborhood of Hudong Road	50 m within pipeline reconstruction	692
West Mountain of Lizigou	50 m within pipeline reconstruction	904
East Mountain of Lizigou	50 m within pipeline reconstruction	512
Pipleine Along Hutai Electronic Vehicle Station, Meidu Road To Maintanence Center	50 m within pipeline reconstruction	432
Two Sides of Liushan No.4 Street	50 m within pipeline reconstruction	20
North Mechanic Community	50 m within pipeline reconstruction	644
Old Buildings In Liushan	50 m within pipeline reconstruction	2430
Across The Street of Hutai Shop	50 m within pipeline reconstruction	820
South of Hutai Street	50 m within pipeline reconstruction	692
Nanling Residence	50 m within pipeline reconstruction	996
Wanxin Dongshan Pump Station – Wudong Building, Dongshang Pan	50 m within pipeline reconstruction	6
Wanxin No.3 Road	50 m within pipeline reconstruction	756
Dongshangpan Bungalow	50 m within pipeline reconstruction	8
Nanchang Road Lizigou Bridge Hold –Shengli Pump Station	50 m within pipeline reconstruction	3
Hutai North Street	50 m within pipeline reconstruction	667
Dongshan Community	50 m within pipeline reconstruction	530
Nearby Area of Huafeng Factory Hospital	50 m within pipeline reconstruction	6
Community Around Lizigou 1# Pump Station	50 m within pipeline reconstruction	1100
No.11 Factory Residence I	50 m within pipeline reconstruction	162

Environment Protection Objective	Distance from the Construction Site（m）	Affected Household
No.11 Factory Residence II	50 m within pipeline reconstruction	162
Qianjinxiang Residence	50 m within pipeline reconstruction	456
9 Buildings In Pingshan Firefighter Depatch	50 m within pipeline reconstruction	771
4 Buildings In Nanhuayuan Bridge	50 m within pipeline reconstruction	212
18 Buildings In Nanhuayuan No.5 Committee	50 m within pipeline reconstruction	924
18 Buildings In Nanhuayuan Post Office Sanli	50 m within pipeline reconstruction	204
4 Buildings In Nanhuayuan Wasteland	50 m within pipeline reconstruction	24
9 Buildings Across Nanhuayuan Palace	50 m within pipeline reconstruction	324
24 Household Building In Liushan	50 m within pipeline reconstruction	24
21 Buildings In Liushan Old Makeshift House	50 m within pipeline reconstruction	945
6 Buildings Below Liushan Post Office	50 m within pipeline reconstruction	336
11 Buildings In Liushan Party School	50 m within pipeline reconstruction	396
12 Buildings on Liushan 5 Building	50 m within pipeline reconstruction	540
Donggang Bridge on Nanchang Road	50 m within pipeline reconstruction	14
Yaodi	50 m within pipeline reconstruction	2540
Guchengzi Nanchang Residence	50 m within pipeline reconstruction	1924
Lizigou Bungalow	50 m within pipeline reconstruction	60
Binhu Yaju Residence	50 m within pipeline reconstruction	430
Old Buildings on Liushan Road	50 m within pipeline reconstruction	1460
Liushan Shiwei	50 m within pipeline reconstruction	1200
Panbei Community	50 m within pipeline reconstruction	1776
Old Building In Donggan Avenue	50 m within pipeline reconstruction	240
Laohutai Building Materials Factory To No.11 Factory Club	50 m within pipeline reconstruction	9
Huxi Community	50 m within pipeline reconstruction	4320
Buildings In Xintun	50 m within pipeline reconstruction	140
Liushan No.3 Road	50 m within pipeline reconstruction	1450
Huwan Xincheng I	50 m within pipeline reconstruction	420
Nearby Area of Wanxin No.2 School	50 m within pipeline reconstruction	15
Wanxin South Street	50 m within pipeline reconstruction	450
Wulaodong Gutter	50 m within pipeline reconstruction	1188

Environment Protection Objective	Distance from the Construction Site（m）	Affected Household
Nearby Area of Gongying Division Pump Station	50 m within pipeline reconstruction	65
Zhongge	50 m within pipeline reconstruction	3381
Qiange	50 m within pipeline reconstruction	3990
North of Hedong Zhuangshicheng Road	50 m within pipeline reconstruction	1736
North of Xinhua Original Municipal Company	50 m within pipeline reconstruction	3003
North And East on Xinhua Chaozhong	50 m within pipeline reconstruction	2452
North of Huaide Road East on Ningyuan Street	50 m within pipeline reconstruction	1748
Shihua Community on Northwest on Jiangjun No.3 School	50 m within pipeline reconstruction	672
East of Petroleum Hospital on North of Xincheng Road	50 m within pipeline reconstruction	1533
Zhongge 110 Building	50 m within pipeline reconstruction	642
Caichen 22 Square	50 m within pipeline reconstruction	1998
Petroleum No.1 Factory Community (Across The Way of Petroleum Hospital)	50 m within pipeline reconstruction	630
Caichen 21 Square	50 m within pipeline reconstruction	1661
West of Jiangjun No.3 Street, East of Meiqi Daguan	50 m within pipeline reconstruction	2709
Jiangjun Cement Factory Community	50 m within pipeline reconstruction	3555
Jian'An Community	50 m within pipeline reconstruction	2037
Kuangdeng Community	50 m within pipeline reconstruction	1162
Qimao Community	50 m within pipeline reconstruction	2754
Icbc Community	50 m within pipeline reconstruction	1667
Bachang Community	50 m within pipeline reconstruction	2823
Yidong Community	50 m within pipeline reconstruction	2864
Meihe Community	50 m within pipeline reconstruction	4557
Ji'An Community	50 m within pipeline reconstruction	2611
Huinan Community	50 m within pipeline reconstruction	2886
30 Buildings on Xincheng Road – Linjiang Road, Zhandong Street– Qian'An Street	50 m within pipeline reconstruction	2063
34 Buildings on Xinhua Road – Linjiang Road, Xinhua Avenue– Qian'An Street	50 m within pipeline reconstruction	2020
37 Buildings on Xinhua No.2 Road – Xincheng Road, Qian'An Street – Fuxi River	50 m within pipeline reconstruction	2193
35 Buildings on Xinhua No.2 Road – Fushuncheng Road, Zhandong Street – Fuxi River	50 m within pipeline reconstruction	3018
39 Building S on Fushuncheng Road, Shenji Line	50 m within pipeline reconstruction	2325

Environment Protection Objective	Distance from the Construction Site (m)	Affected Household
28 Buildings on Xinhua No.2 Road, Fuchuncheng Road, Zhandong Street, Qian'An Street	50 m within pipeline reconstruction	2452
42 Building on Xinhua No.3 Road –Xincheng Road, Qian'An Street, Xinhua Avenue	50 m within pipeline reconstruction	2536
33 Buildings on Xinhua Street – Ningyuan Street, South of Linjiang Road	50 m within pipeline reconstruction	3003
42 Buildings Along Ningyuan Street – Railway Bridge, Linjiang Road	50 m within pipeline reconstruction	2326
55 Builings on Xinhua Avenue – Ningyuan Street, Xincheng Road –Linjiang Road	50 m within pipeline reconstruction	8684
13 Buildings on Xincheng Road – Mechanical Factory, Ningyuan Street - Railway	50 m within pipeline reconstruction	645
36 Buildings on Xincheng Road – Huaide Road, Guide Street, Railway Bridge	50 m within pipeline reconstruction	1444
21 Buildings on Huaide Road –Fushun Prison, Ningyuan Street – Railway	50 m within pipeline reconstruction	1579
Xincheng No.4 Road –Xincheng No.5 Road, Guide Street, Outside West Gate of Lvmantingfang	50 m within pipeline reconstruction	926
Xincheng No.5 Road –Xincheng Road, Guide Street, Outside West Gate of Lvmantingfang	50 m within pipeline reconstruction	1980
North of Xincheng Road East on Changchun Street	50 m within pipeline reconstruction	965
Xincheng No.4 Road, Xincheng No.3 Road, Xincheng Street – Xinhua Street	50 m within pipeline reconstruction	340
Xincheng No.3 Road – Fushuncheng Road, Xincheng Street	50 m within pipeline reconstruction	614
West on Ningyuan Street, North of Jinfeng Garden	50 m within pipeline reconstruction	1903
Laomo Apartment on Gaoshan Road	50 m within pipeline reconstruction	348
West of Tianfeng Building on Xincheng Road	50 m within pipeline reconstruction	739
16 Buildings on Fushucheng Road – Railway, Northern Station – Guide Street	50 m within pipeline reconstruction	1211
9 Buildings on Fushucheng Road – Railway, Ningyuan Street – Guide Street	50 m within pipeline reconstruction	433
North of Xincheng Road And West on Changchun Street	50 m within pipeline reconstruction	900
45 Buildings on Xincheng Road- Linjiang Road, Huichun Street – Fuxi River	50 m within pipeline reconstruction	2126
35 Buildings on Xincheng Road-Linjiang Road, Changchun Road – Huichun Street	50 m within pipeline reconstruction	1713
56 Buildings In Hedong Zelin Community	50 m within pipeline reconstruction	600
30 Buildings on West of Gebu North Street	50 m within pipeline reconstruction	787
Gebu North Street (Xincun)	50 m within pipeline reconstruction	777
South of Xincheng Road And North of Linjiang Road, East on Changchun Street And West on Celongcheng Street	50 m within pipeline reconstruction	2063
Gebu Road Qiange Traffic Post	50 m within pipeline reconstruction	1035
South of Gebu Road Business Office	50 m within pipeline reconstruction	567
West of Jiangjun Street South of Linjiang Road	50 m within pipeline reconstruction	1890

Environment Protection Objective	Distance from the Construction Site（m）	Affected Household
Shihua Community on South of Linjiang Road	50 m within pipeline reconstruction	1198
West of Linjianglu And Nanhuichun Street	50 m within pipeline reconstruction	948
Bolin Mingjun	50 m within pipeline reconstruction	524
Gaoshan Road Xiangshan Villa	50 m within pipeline reconstruction	1750
Taidong Huayuan	50 m within pipeline reconstruction	285
Sanhe Community	50 m within pipeline reconstruction	1814
Shuiyuan Community	50 m within pipeline reconstruction	2644
Fengdong Community	50 m within pipeline reconstruction	1662
Fengxiang Community	50 m within pipeline reconstruction	1964
Xinguang Community	50 m within pipeline reconstruction	1587
Hualong Community	50 m within pipeline reconstruction	2116
Gongyuan Community	50 m within pipeline reconstruction	1511
Licui Community	50 m within pipeline reconstruction	1964
Yulin Community	50 m within pipeline reconstruction	1813
Taidong Huayuan II	50 m within pipeline reconstruction	215
Yongning Community	50 m within pipeline reconstruction	1662
Donggang Community	50 m within pipeline reconstruction	2116
Youyi Community	50 m within pipeline reconstruction	1964
Xueyuan Community	50 m within pipeline reconstruction	1662
Nanyang Community	50 m within pipeline reconstruction	2644
Nantai Community	50 m within pipeline reconstruction	1162
Dongyi Road Community	50 m within pipeline reconstruction	1813
Beitai Community	50 m within pipeline reconstruction	1964
Yingbin Community	50 m within pipeline reconstruction	2116
Huashan Road Bungalow	50 m within pipeline reconstruction	90
Dongsan Road Community & Xigongyuan Community	50 m within pipeline reconstruction	2116
Minzhu Road Community	50 m within pipeline reconstruction	1813
Dongba Road Community	50 m within pipeline reconstruction	2191
Jiefang Road Community	50 m within pipeline reconstruction	1662
Shangyecheng Community	50 m within pipeline reconstruction	1436

Environment Protection Objective	Distance from the Construction Site (m)	Affected Household
Xijiulu Community	50 m within pipeline reconstruction	2191
Yucai Community	50 m within pipeline reconstruction	2267
Xiyi Road Community	50 m within pipeline reconstruction	1511
Baiyun Community	50 m within pipeline reconstruction	1964
Qianjin Community	50 m within pipeline reconstruction	1360
Xinxing Community	50 m within pipeline reconstruction	1587
Fuping Community	50 m within pipeline reconstruction	1964
Nanyuan Community	50 m within pipeline reconstruction	1511
Liantong Community	50 m within pipeline reconstruction	1436
Yuanxue Community	50 m within pipeline reconstruction	1662

Source: the domestic EA

(4) Environment Protection Objectives for Fuxin Project

Table IV-22 Sensitive Receptors and Protection Objectives – Fuxin

Environmental Protection Objective	Location/ Distance (m)	Affected Household/Person	Environmental Impact Factor	Protection Requirement
Xindi Village	Adjoining to both sides of pipe	37 Households/148 Person	dust, noise, construction safety	Grade II in Ambient Air Quality Standard (GB3095-2012)；Class II in Acoustic Environment Quality Standard (GB3096-2008)
Jianbalahuang Village	22m East of pipe	11 Households/44 Person		
Hexi Village	Adjoining to both sides of pipe	35 Households/140 Person		
Hedong Village	Adjoining to both sides of pipe	47 Households/188 Person		
Changxin Community	12m East of pipe	291 Households/1164 Person		
Xishan Quyu Residence	Adjoining	357 Households/1428 Person		
Sanyiba Quyu Residence	Adjoining	558 Households/2233 Person		
Miaopo Shichang Residence	Adjoining	513 Households/2054 Person		
Jinxiujiayuan Community	Adjoining	287 Households/1147 Person		
Shuhuayuan Community	Adjoining	294 Households/1175 Person		
Min'an Community	Adjoining	592 Households/2365 Person		
Kangleyuan Community	Adjoining	483 Households/1930 Person		
Hengye I Community	Adjoining	202 Households/805 Person		
Hengye II Community	Adjoining	151 Households/604 Person		

Dianchang Shuangyue Residence	Adjoining	362 Households/1445 Person		
Longxinjiayuan I Community	Adjoining	268 Households/1071 Person		
Shanzhongjie Residence	Adjoining	229 Households/915 Person		
Jinghua Xinrenlei Community	Adjoining	288 Households/1150 Person		
Guangming Community	Adjoining	606 Households/2422 Person		
Kaifaq Residence	Adjoining	430 Households/1717 Person		
Jiaoyuxueyuan Residence	Adjoining	359 Households/1435 Person		
Dongshichang Residence Area	Adjoining	282 Households/127 Person		
Minzujie Residence Area	Adjoining	359 Households/1435 Person		
Buxingjie Residence Area	Adjoining	282 Households/1127 Person		
Qinghemen Kuangbeishan Residence	Adjoining	215 Households/860 Person		
Tielu Residence	Adjoining	60 Households/240 Person		
Chenxianqu Residence	Adjoining	920 Households/3678 Person		
Ping'an Zhongbu	Adjoining	631 Households/2522 Person		
107 Residence	Adjoining	623 Households/2489 Person		
Hongshu Residence Area	Adjoining	523 Households/2092 Person		
Zhanqianxi Community	Adjoining	162 Households/649 Person		
Jianjing Community	Adjoining	68 Households/272 Person		
Jiuyingzihe River	Pass Through	/		Class III in Surface Water Quality Standard (GB3838-2002)
Qinghe River	Pass Through	/		

Source: the domestic EA

(5) Environment Protection Objectives for Gaizhou Project

Table IV-23 Sensitive Receptors and Protection Objectives-Gaizhou

Environmental Protection Objective	Location/ Distance	Affected Household/Person	Environmental Impact Factor	Protection Requirement
Mentun Village	80m Ease of Water Pipe	25 Households/100 Person	dust, noise, construction safety	Grade II in Ambient Air Quality Standard (GB3095-2012) Class II in Acoustic Environment Quality
Caijiatun Village	20 m South of Water Pipe	20 Households/60 Person		
Dabaling Village	160 m North of Water Pipe	15 Households/50 Person		

Dongbaling Village	20 m South and 10 m North on both Sides of Original Pipe	90 Households/270 Person		Standard (GB3096-2008)
Guanjiadian Village	20 m South and 10 m North on both Sides of Original Pipe	75 Households/225 Person		

Source: the domestic EA

V. Due Diligence for Associated Facilities

115. A due diligence for the associated facilities of the project was conducted by the consultants and the EA Institutes based on the requirement of the World Bank Safeguard Policy. The followings are classified as facilities associated to this project: (i) the four reservoirs and dams; (ii) the two domestic financed WSPs in Fuxin City; and (iii) the operational capacity of the existing WWTP in five project Cities.

V-1 Reservoir Dams

116. The proposed Project does not involve any activities to construct or rehabilitate dams. However, four existing reservoirs are associated with the Project, which are raw water sources of the subprojects in the five project cities. The four due diligence reports for the safety of reservoir dams were completed by the local consulting firm, with the parameters and safety evaluation results of dams/reservoirs, which are shown in **Table V-1** below.

117. According to the report, the dams safety assessments for the reservoirs/dams were conducted by Liaoning Provincial Water Conservancy Department (LWCD) in 2012, and the assessment conclusions include: (i) that the major assessment items of main dam structures all the four associated dams assessed as Grade A; (ii) three dam steel structures were assessed as Grade A (Dahuofang Reservoir is Grade B); (iii) dam seepage functions for all the four associated dams were assessed as Grade A; (iv) the overall evaluation of dam safety for the 4 dams are A first-class dams; (v) the comprehensive safety assessment of three reservoirs is Class I except Tanghe Reservoir of Class II; and (vi) the operation assessment of all four dams is relatively good. And the approval certificates to the 4 associated reservoirs/dams were issued in 2012.

Table V-1 Main parameters and evaluation results of the associated reservoirs/dams

Dam/reservoir	Nadehai Reservoir	Shimen Reservoir	Dahuofang Reservoir	Jiaohe Reservoir
Subproject related	Fuxin subproject	Gaizhou subproject	Shenyang & Fushun	Anshan
Completion year	1942	1971	1958	1969
Consolidating and de-danger years	4 times (1965, 1970, 1991-1994, and 2007-2010	2times (1974-1975, 1986)	4 times (the latest one was 2002-2006	2011-2014
Storage capacity	168.3 million m3	108 million m3	2.268 billion m3	626 million m3
Type of dam	Concrete gravity dam	Clay-core dam	Rolling compacted clay core dam	clay sloping san dam
Designed flood standard	Once in 50 years	Once in 200 years	Once in 1,000 years	Once in 1,000 years
Length of dam	167m	350m	1367m	455m
Height of dam crest	194m	47m	139.8m	118.66m
width of the dam crest	4m	6m	52m	6m
normal water level	181.5m	145m	131.5m	109.36
Evaluation of dam structure	Grade A	Grade A	Grade A	Grade A
Evaluation of dam steel structure	Grade A	Grade A	Grade B	Grade A

Evaluation of dam Seepage	Grade A	Grade A	Grade A	Grade A
Overall evaluation of dam	A first-class dam	A first-class dam	A first-class dam	A second-class dam
Agency issued the appraisal certificate	Liaoning Provincial water conservancy Department	Liaoning Provincial water conservancy Department	Liaoning Provincial water conservancy Department	Liaoning Provincial water conservancy Department
No. of Appraisal certificate	Liao-Shui-jian-Guan (2012)419	Liao-Shui-jian-Guan (2012)419	-	-
Date of issuing appraisal certificate	28 Feb. 2012	28 Feb. 2012	-	-
Number of operation staff	75	213	248	208
Emergency plan preparation	Yes	Yes	Yes	Yes

Source: the Dam Safety Assessment Reports

Figure V-1 Naodehai Reservoir after reinforcement in 2011

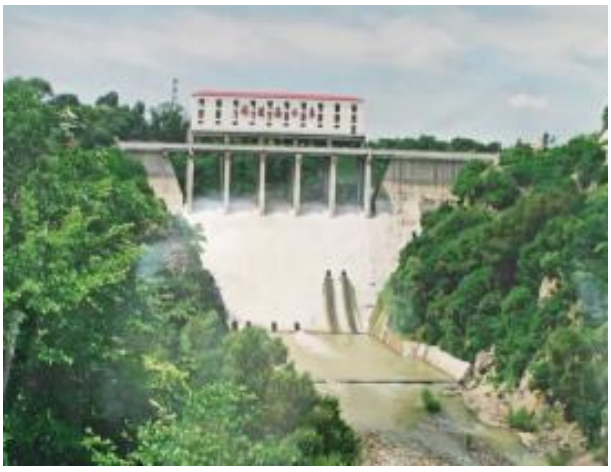


Figure V-2 Impounding reservoir project in Naodehai Reservoir

Figure V-3 Slope surface after reinforcement in Shimen Reservoir

Figure V-4 Reinforced right wall of spillway in Shimen Reservoir

Figure V-5 Main spillway in Dahuofang Reservoir

Figure V-6 Water intake gate for water supply in Fushun City in Dahuofang Reservoir

Figure V-7 Reconstructed downstream slope protection for Tanghe Reservoir dam

Figure V-8 Reconstructed spillway of Ranghe Reservoir

V-2 Associated WSPs of Fuxin

118. The two domestic funded WSPs in Fuin will be constructed in 2017, which are considered as the associated facilities to this project. The due diligence was conducted by the EA Institute during the project preparation, which shows that: i) the two FSRs and preliminary designs have been approved by Fuxin Municipal DRC in 2016; ii) the two domestic EA reports have been approved by Fuxin Municipal EPB in May 2016; iii) the environmental acceptance for the WSPs is scheduled in January 2018 (**Table V-2**)

Table V-2 Due Diligence for the associated WSPs in Fuxin

Name of WSP	Qinghemen District WSP	Fuxin Urban WSP
Designed treatment capacity	100,000 m3/d	100,000 m3/d
Floor space	96.17 mu (6.41ha)	108.96 mu (7.26 ha)
Water treatment process	Conventional process	Conventional process
Raw water source	Surface water	Surface water
Major impacts during construction	Dust, noise and traffic safety	
Major mitigation measures during construction	i) spraying water on construction sites and transport routes, cover vehicles, earth and construction materials on site for dust control; ii)Installation of separators around the sites, and limit construction	

	time for noise control; iii)make proper traffic management plan together with the local traffic polices to ensure traffic safety and prevent traffic jam.	
Major impacts during operation	Noise impact, and chlorine leakage during operation	
Major mitigation measures during operation	i)installation of low-noise pumps and blowers with soundproof enclosures for noise control in the WSPs and pumping stations; ii) establishment of emergency response mechanism for chlorine leakage accidence including detection, warning and treatment equipment.	
EIA approval authority	Fuxin Municipal EPB	Fuxin Municipal EPB
EIA approval date	6 may 2016	26 May 2016
EIA approval document	Fu_Env_Appr(2016)22	Fu_Env_Appr(2016)22
Expected date for environmental acceptance	January 2018	January 2018

Source: EA Institute

V-3 The Two Gaizhou existing WSPs and Yingkou Guotun WSP

119. The Gaizhou adjusted project includes upgrading the two existing WSPs in Gaizhou, and 40,000 m^3/d clean water diversion from the existing Yingkou Guotun WSP. The Gaizhou EIA Institute conducted the due diligence for the three WSPs in May 2017, with the conclusion of: i) the three WSPs are operating normally, ii) the domestic EIAs of three WSPs were approved before the constructions, without any leftover environmental issue. (Table V-3).

Table V-3 Due Diligence for the three WSPs in Gaizhou and Yingkou

Name of WSP	Gaizhou Taishan WSP	Gaizhou Henan WSP	Yingkou Guotun WSP
Location of WSP	Foot of Taishan hill	Nearby Henan Village in the Economic Development Zone (South bank of Daqqing River)	Nearby Guotun Village, Tuanding Town, Yingkou City
Location of water source	Groundwater under the north bank of Daqing River	Groundwater under above location	Surface water from Shimen Reservoir
Designed treatment capacity	45,000 m^3/d	20,000 m^3/d	70,000 m^3/d
Floor space	0.99 ha	1.2 ha	3.15 ha
Water treatment process	Groundwater + chlorination	Groundwater + chlorination	Conventional surface water treatment process
EIA approval authority	Gaizhou Municipal EPB	Gauzhou Municipal EPB	Liaoning Provincial EPD
EIA approval date	August 2010	April 2003	August 2006
No. of EIA approval document	Gai_Env_Appr(2010)52	-	-

Source: Gaizhou EA Institute

V-4 Wastewater Treatment Facilities

120. **Shenyang**. There are 34 existing WWTP in Shenyang city with the total processing capacity of 2.5046 million m3 / d, sewerage rate of 87.2%, including 27 sets of WWTP within the administrative regions in Shenyang with total processing capacity of 2.2445 million m3 / d. The Shenyang project does not include the construction of new WSP, but after pipeline project, it can reduce the water supply pipe network leakage rate, which can realize water supply of 1.7293 million m3 / d. Forward in Shenyang in 2030, water supply is expected to be 1.9574 million m3 / d, the status quo sewage treatment capacity has exceeds tap water capacity, which can completely meet the requirements after the project completion as well as the long-term water demand scale, the implementation of this project will not result in increase of pollution load. WSP status within the administrative regions in Shenyang is shown in **Table V-4**.

Table V-4 WSPs in Shenyang Administrative Regions

No.	Name of WSP	Design Capacity (in 10,000m/d)	Construction/Operation Date	Effluent Discharge Direction
1	Shenyang Nanbu WWTP	60	2012.10	Hun River
2	Beibu WWTP	40	1994- 1998.8	Xinkai River, Weigong Canal
3	Xannvhe WWTP	40	2003.7- 2003.12	Xi River
4	Shenshuiwan WWTP	20	2000-2003.11	Hun River
5	Nanxiaohe WWTP	1	2005.6-2005.10	Nanxiao River
6	Huibeihe WWTP	0.5	2005.5-2005.10	Huishan River
7	Hushitai Beichengzhen WWTP	2.5	2008	
8	Hushitai Nan WWTP	2.5	-	
9	Puhe Beibu WWTP	2	2008.7-2009.7	Pu River
10	Daoyi WWTP in Shenbei New District in Shenyang	2.5	2009.8-2010.12	Nanxiao River through municipal pipe
11	Shenyang Xibu WWTP	15	2005.7-2006.6	Xi River
12	Shenyang Mantanghe WWTP	2	2003.5-2003.9	Mantang River
13	Hunnan Shangjiahe WWTP	4	2006.10-2008.6	Hunnan Canal
14	Dongling Baita WWTP	2	2008.9-2009.9	Baitabao River
15	Shenyang Sujiatun District WWTP	5	2008.9-2011.5	Beisha River
16	Shenbei New District Xinchengzi WWTP	2.5	2008.4-2009.7	Chang River
17	Qipanshan Mantang WWTP	1.0	2008.5-2009.10	Mantang River
18	Yuhong District Shaling WWTP	2	2008.8-2011.6	Xiaohun River
19	Huishan Mingqu WWTP	3	2007.4-2007.10	Hun River
20	Mantang Resettlement WWTP in Qipanshan Development District	0.1	2007-2008	
21	Shenyang Jinhai Economic District WWTP	6		In construction
22	Yuhong District Zaohua WWTP	7	2009.4	Pu River
23	Yuhong District Luoping Wetland WWTP	0.2	2009-2010.5	Pu River
24	Huagong Park WWTP	1	2010	
25	Shenyang Huinan New District Industrial Zone WWTP	2	2008-2010.11	Baitabao River

26	Sujiatun Steel Tube Industrial Zone WWTP	0.5	2009	Treated by acid pic kle
27	Dongling District Lixiang WWTP	0.05		
	Total	**224.35**		

121. **Anshan**. There are currently 5 WWTPs in Anshan, which include Ningyuan WWTP, Dagushan WWTP, Dongtai WWTP, Dadaowan WWTP, Panjialu WWTP. The total wastewater treatment capacity is 560,000 m3/d. the details are in **Table V-5**.

Table V-5 Anshan WWTP Status

No.	Name of WWTP	Treatment Capacity (m^3/d)	Treatment Technology	Discharge Standard
1	Ningyuan WWTP	8×10^4	CAST Tech	Class I A
2	Dagushan WWTP	3×10^4	CAST Tech	Class I A
3	Dongtai WWTP	10×10^4	A^2/O Tech	Class I A
4	Dadaowan WWTP	30×10^4	A^2/O Tech	Class I A
5	Panjialu WWTP	5×10^4	CAST+ advanced treatment Tech	Class I A
Total		**56×10^4**		

Source: EA Institute.

122. According to city's planning, water supply capacity will reach 680,000 m3/d in 2040 in Anshan, discharge amount is calculated as 80% of the water supply, sewage quantity will be 544,000 m3/d then, according to the data provided by Anshan Environmental Protection Bureau, and take 97% as the present situation of sewage collection rate, sewage discharged into the regional sewage pipe network will be 528,000 m3/d.

123. Above all, sewage treatment capacity is 560,000 m3/d Anshan, the sewage discharge will be 528,000 m3 /d. In 2040, it is expected that sewage pipe network and sewage treatment plants have enough ability to accept, the new pollution load will not be increased due to the implementation of this project.

124. **Fushun**. There are 8 WWTPs in Fushun with a total capacity of 593,000 m^3/d and sewage pipe network collection rate of 98%.The proposed WB loaned Sushun project does not include new WSP construction, then the water supply amount is not increased. Currently, the city highest water supply of tap water is 614,000 m3/d, take the discharge rate of 80%, the discharge amount is calculated as 491,200 m3/d. The treatment capacity of the WWTP is larger than the amount produced by the WSPs. As a result, after the completion of this project, no adverse impact will be on the environment.

125. **Fuxin.** WWTP in Fuxin include Qingyuan WWTP (100,000 m3/d), Mongolia Zhen WWTP (50,000 m3/d), ZhangWu Liyuan WWTP (20,000 m3/d), Qinghemen Jinyuan WWTP (35,000 m3/d), Fuxin Development Zone WWTP (100,000 m3/d), the total sewage treatment capacity of Fuxin is 305,000 m3/d. The present sewage collection rate is about 94%. The total designed water supply capacity of tap water is 445,400 m3/d, due to the limitation of water source, the actual water supply capacity is 350,000 m3/d, take sewage discharge rate as 75% of the water supply, the wastewater need to be treated is 246,800 m3/d, which is less than the total treatment capacity of WWTP. As a result, after the completion of this project, no new pollution load will be added.

126. **Gaizhou.** The designed treatment capacity of Gaizhou WWTP is 50,000 m3/d adopting suspended chain aerating technology. The actual waste water treatment quantity is 38,500 m3/d, of which, the quantity of industrial wastewater treatment is 4,000 m3/d, domestic waste water quantity is 34,500 m3/d. The current urban sewage collection rate is 100%. There are 2 WSPs in Gaizhou taking groundwater as water source (Tashan WSP and Henan WSP) with total water supply capacity of 40,000 m3/d. The proposed WB loaned project includes taking treated water from Yingkou Water Supply Company with capacity of 50,000 m3/d, which will gradually replace two groundwater water plant. After the completion of the proposed project, the net increase of water supply will be 10,000 m3/d, taking 80% as the discharge rate of water supply, 8000 m3/d of sewage discharge will be added. At the current situation, the sewage treatment plant surplus is 11,500 m^3/d, which can completely accommodate the increased wastewater discharge during the project operating period and will not result in new pollution.

VI. Organizations for Environmental Management

127. **Provincial Level.** The Liaoning Provincial Leading Group (LPLG), chaired by a Vice Governor of the province, will provide high-level guidance to the project, and coordinate on policy and institutional issues related to the project. A well-established office under the Liaoning Provincial Housing and Construction Department (LPHCD), called the Liaoning Urban Construction and Renewal Project Office (LUCRPO), will provide overall project management. The Liaoning Provincial Department of Finance (LPDF) will responsible for integrated management of the Project, including providing guidance to the LUCRPO and the five project cities, and managing the project designated accounts. The Liaoning Provincial Development and Reform Commission (LPDRC) will be responsible for providing overall infrastructure planning management in Liaoning, and developing policies that will promote economic reform and development.

128. **Municipal Level.** Each participating city will have a City Leading Group (CLG), in which government leaders participate. The CLGs will be responsible for providing policy guidance, and coordination support for the project. Each city's water supply company will be the project implementation agency (IA) for manage its subprojects implementation.

129. LUCRPO and the IAs will: (i) be responsible for overall management of project implementation; (ii) ensure agency coordination; (iii) monitor progress and quality of project implementation; and (iv) coordinate communications with relevant government agencies.

130. LUCRPO and IAs will also be responsible for implementing the environment and social management during the project implementation, including EMP, SAR and RAP, consisting of inspection, monitoring, reporting, and initiating corrective actions or mitigation measures, with the organization shown in Figure1 below.

131. **LUCRPO's and IAs' Environmental Officers.** LUCRPO, as well as IAs will each appoint an Environment Officer who will be responsible for implementation of the EMP. The officer will take charge of: (i) overall coordination of the EMP; (ii) supervising the implementation of mitigation measures during project construction and operation; (iii) supervising contractors and construction supervision companies (CSCs) internal monitoring, and coordinating the external and compliance monitoring; (iv) ensuring that environmental management, monitoring, and mitigation measures are incorporated into bidding documents, construction contracts and

operation management manuals; (v) reporting the EMP performance to the LUCRPO and the World Bank; (vi) together with the LUCRP's Social Officer, coordinating the Grievance Redress Mechanism (GRM); and (vii) responding to any unforeseen adverse impact beyond those mentioned in the domestic EIAs, the project EA and the EMP. The Environment Officer will be technically supported by the loan environmental implementation consultant (LIEC) and supervised by the provincial EPD. LUCRPO will engage a project management company including experienced environmental specialists to provide LUCRPO and IAs with technical guidance.

132. The list below is the proposed staffs of LUCRPO and the WSCs, who are responsible for environmental management during the project implementation.

Organization	Name of staff	Telephone	Mail
LUCRPO	Wang Yongli	13130238109	lucrpochina@vip.163.com
Shenayng WSC	Xin Lu	13840256295	-
Anshan WSC	Wang Xun	13889726268	17890401@qq.com
Fushun WSC	Liu Sugang	15641391133	-
Fuxin WSC	Yang Wei	15641876660	261231132@qq.com
Gaizhou WSC	Wu Zhensheng	15009833444	-

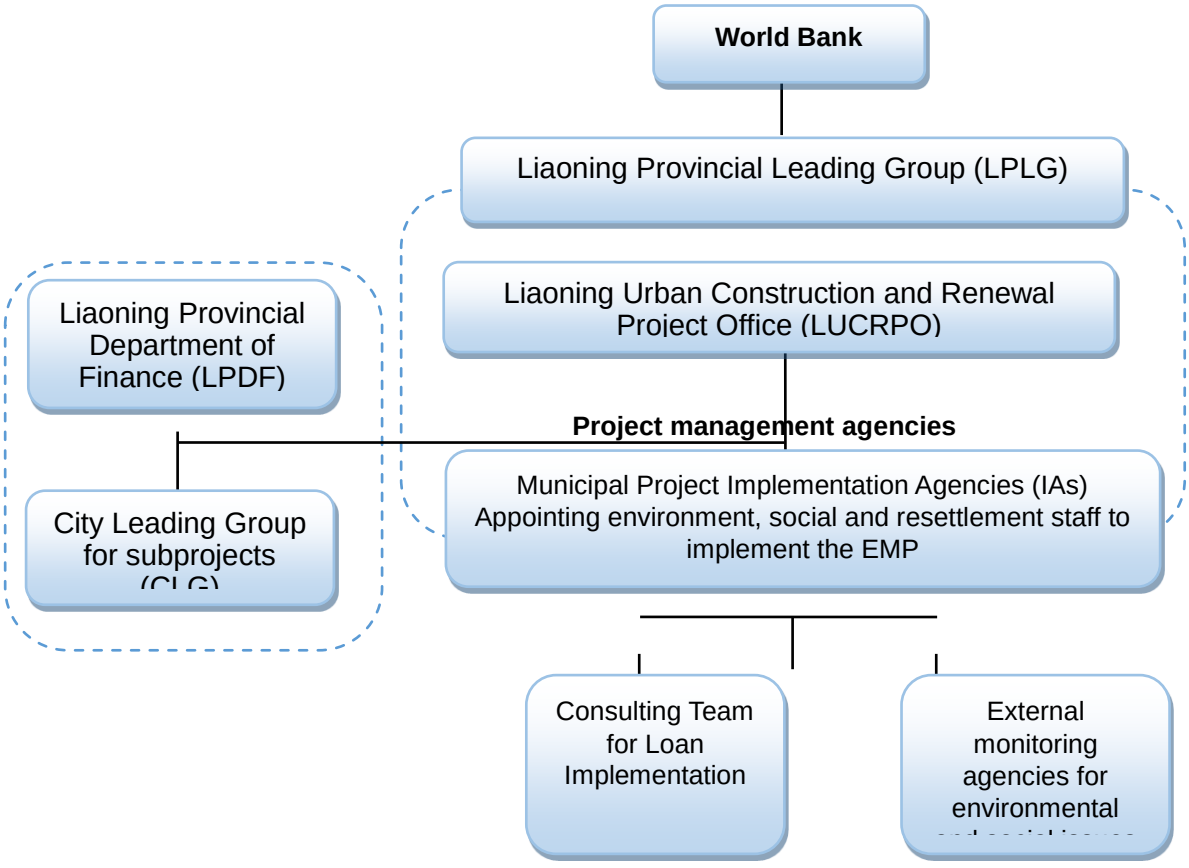


Figure VI-1 Organizational Chart for environment and social management of the Project

133. At the stage of detailed engineering design, LUCRPO, through the IAs, will pass the EMP to the design institutes to have mitigation measures incorporated into the detailed design. The

EMP will be updated at the end of the detailed design phase and finally incorporated in bidding documents and construction contracts. To ensure that the contractors comply with the EMP's provisions, the environmental officers, with the support of the LIEC, will prepare and provide the following specification clauses, to be incorporated into the bidding procedures: (i) a list of environmental management requirements to be budgeted by the bidders in their tender documents; (ii) environmental clauses for contractual terms and conditions; and (iii) major items in the domestic EIAs, the English EA and EMP.

134. **Loan Implementation Environment Consultant.** A LIEC will be hired under the loan implementation technical assistance (TA). The LIEC will advise LUCRPO and IAs, contractors and CSCs on all aspects of environmental management and monitoring for the project. The LIEC will: (i) assist LUCRPO and IAs in updating the EMP, including the environmental monitoring program; (ii) verify implementation of the EMP mitigation measures; (iii) review internal and compliance monitoring reports and the semi-annual external environment performance/monitoring reports; (iv) provide training to LUCRPO, IAs, CSCs, and contractors on the PRC's environmental laws, regulations and policies, WB safeguard policies, EMP implementation, and GRM; (v) identify any environment-related implementation issues, propose necessary corrective actions, and reflect these in a corrective action plan; (vi) help LUCRPO and IAs prepare semi-annual environmental monitoring and progress reports to the World Bank; and (vii) undertake regular site visits.

135. **Construction contractors.** Construction contractors will be responsible for implementing relevant mitigation measures and internal monitoring during construction with the help of CSCs and under the supervision of the city EPB. Prior to commencing civil works, the contractors are to submit site-specific management plans based on the project ESMP, which includes, among others, (i) work activities; (ii) traffic management; (iii) occupational health and safety; and (iv) environmental and social impact management. No civil works will commence until the site specific management plan has been approved by the supervision engineer/company. Community consultations should be conducted by civil work contractors at least once a year. Any environmental and social issues associated with the project raised are to be actively followed up by the civil work contractors. Civil work contractors are requested to have the Grievance Redress Mechanism (GRM) to address grievance/complaints on the construction activities.

136. **Construction supervision companies.** CSCs will be selected through the PRC bidding procedure, which will be coordinated by LUCRPO and/or IAs. The CSCs will oversee construction progress and quality and EMP implementation. Each CSC shall have at least one environmental engineer on their respective construction site to: (i) supervise the contractor's EMP implementation performance; (ii) conduct internal environmental inspection and monitoring; (iii) fill out monthly environmental performance forms to be submitted to LUCRPO, the loan implementation TA consulting team and the IAs; and (iv) prepare the contractor's environmental management performance section in monthly project progress reports submitted to LUCRPO.

137. **Project cities' Environmental Monitoring Stations (EMSs).** Each project city EMS will ensure compliance with PRC environmental standards and regulations through implementation of the project environmental monitoring program (Take regular and random environmental compliance monitoring during construction and operation. The EMS will conduct the compliance monitoring on behalf of the city EPB.

138. **Institutional strengthen training**. The capacity of WB loaned project management agency is critical for effective environmental management. The training plan is prepared based on the capacity assessment of LUCRPO and five IAs. The training and seminars will be provided by loan implementation environment consultants and provincial EPD, municipal EPB and relating experts. Besides LUCRPO and IAs, the trainees includes staff in contractor and construction supervisors. Training will be prominent international engineering practices and environment friendly methods, embody the water source protection and other environmental targets, environment rehabilitation for construction site, leakage rate reduction and the water supply industry energy conservation and emissions reduction, etc. (see **Table VI-1**).

Table VI-1 Institutional Strengthen and Training Plan for Environmental Management Agency

Training	Participates	Content	No. of Times	Duration	No. of Participates	Budget (in 10,000 CNY)

Environmental laws, regulations and policies in WB and PRC	LUCRPO，IAs, Contractors, and relating staff from EPB	• WB Safeguard and EHS;
		• Environmental laws, regulations and policies in WB and PRC；
		  • civil engineering, water supply plant and pipeline) environmental management best practices; ；
		  • surface water and drinking water sources protection laws, regulations and standards in PRC
			2	1	30	1.0

GRM	LUCRPO，IAs, Contractors, Construction Supervisors, residents near the project and the villagers' representatives, relating staff from municipal EPB	• GRM composition, principle, responsibility and time frame；. • Type and qualification of complaint； • Complaint filing and reporting process。	2	1	30	1.0
Implementation of EMP	LUCRPO, IAs, Contractors Construction Supervisors, EPB, Loan Implementation Environment Consultant	• Duties specified in EMP and specific implementation method； • Water supply plant environmental protection content during construction and operation period； • Environmental forms and reports (daily report and monthly report)；	2	1	30	1.0

Training	Participates	Content	No. of Times	Duration	No. of Participates	Budget (in 10,000 CNY)
		• Update EMP				
Low carbon water supply	LUCRPO , IAs, Water Utility Bureau	• Water supply industry, energy saving and greenhouse gas emissions ; • Best practices and methods in energy conservation and emissions reduction of water supply industry ; • NRW strategy and methods。	2	1	30	1.0
Environmental accident emergency plan		• Environmental accidents and preventive and control measures ; • Emergency response mechanism, the team, and action.	2	1	30	1.0
Environmental monitoring, inspection and reporting	Contractors, Construction Supervisors, EMS, EPB, Loan Implementation Environment Consultant	• Environmental monitoring, inspection method, data collection, processing, interpretation and reporting procedures for WB projects ; • QA/QC in environmental monitoring	1	1	20	0.4
Total						**5.4**

VII. Anticipated Environmental Impacts and Mitigation Measures

VII-1 Assessment of potential impacts

139. As described in the Chapter II, the physical constructions in five project cities include rehabilitations of WSPs, constructions or rehabilitations pipes, valves, raw water pumping stations and secondary boosting pump stations. The intelligent water utility subprojects will be constructed and installed within the buildings such as detachment room in the WSCs. The content of projects in five cities are almost same, so that the expected environmental impacts and proposed mitigation measures are similar for the five project cities.

140. Potential project impacts, both positive and negative, were assessed during the domestic EA and FSRs preparation, through site visits, technical analysis and consultations with government agencies and local communities. A range of potential positive and adverse impacts were identified.

141. Positive impacts include direct improvements to water quality and supply to a large majority of residents in the five project cities, climate change adaptation and reduced water and energy losses, and pollution control. Potential construction impacts include noise, air, and water pollution, fugitive dust, soil erosion and contamination, solid waste disposal, interference with

traffic and municipal facilities, land acquisition and resettlement, and occupational and community health and safety. Potential operational impacts include noise and energy use of pumps in the WSPs and pumping stations, occupational health and safety during operations of WSPs and pumping stations. Potential adverse impacts during operation include noise generated by WSP and pumping stations, energy consumption by water supply, occupational health and safety of operation.

VII-2 Project Benefit

142. **Beneficiaries**. By the project completion year of 2022, the project will benefit a total of 5.6906 million people, including 2.7884 million of female (about 49%). The benefits include increased water supply coverage, improved water quality, facilitated the social and economic development and living standards, energy conservation and emissions reduction, saving water resources and increase employment opportunities, etc.

143. **NRW reduction and water saving**. By rehabilitation of aged pipes and valves, installation of new water meters, as well as strengthening the intelligent water management systems, etc., by the project completion year of 2022, the NRW will reduce by 6.9% (Anshan) - 29.0% (Gaizhou), respectively. The total estimated annual water saving by water supply leakage reduction is about 113. 555 million m^3. (Table VII-1)

Table VII-1 Estimated NRW Reduction and Water Saving

City	Current NRW (%)	Estimated NRW after Project Completion (%)	Reduced NRW (%)	Physical Water savings from Leak Reduction (m^3/year)
Shenyang	33.0	24.0	9.0	62,572,680
Anshan	30.9	24.0	6.9	10,288,354
Fushun	38.8	22.13	16.67	27,368,191
Fuxin	25.7	16.2	9.5	9,092,637
Gaizhou	64.1	35.1	29.0	4,232,873
	Total			113,554,735

Date source: Estimated by the expert in the World Bank Mission in May 2017

144. **Energy Conservation and Emissions Reduction Benefits.** Through technical upgrading of the WSPs and pumping stations (replacement FM pumps, water pumps size, etc.), improvement of intelligent water management systems and water supply dispatching management strengthening in the five project cities, by the project completion year of 2022, it is expected to save power of 77.856 million kWh annually according to the estimation by the expert of the World Bank, equivalent to 73,963 tons/year of carbon dioxide emission reduction.

Table VII-2 Estimated Power Saving (KWh) and Emission Reduction

City	Energy Savings from NRW Reduction and Energy Management Improvement by 2022 (kWh/year))	CO_2 Emissions Reduction by 2022 (ton/year)
Shenyang	50,846,455	48,304
Fushun	8,412,040	7,991
Anshan	1,366,472	1,298
Fuxin	9,821,250	9,330
Gaizhou	7,409,865	7,039

Total	77,856,083	73,963

Date source: Estimated by the expert in the World Bank Mission in May 2017

VII-3 Specific Impact Analysis and Mitigation Measures

145. **Identification of Environmental Impact Factors**. According to the content and characteristics of the project, the main environmental impact is pipeline, WSPs (rehabilitation) and the influence of the pumping stations during construction period; during operation phase, the main impcats will be the reduction of water source quantity caused by increase of water supply and wastewater discharge increase caused by the water leak rate reduction. In addition, pipeline construction can cause temporary traffic jams, and may interfere the gas, heating, power supply, water drainage, and other municipal underground pipeline, thus some adverse environmental impact on residents' life and work.

146. During the construction, building materials transport and temporary storage and use, and soil spoil and temporary building materials pool may generate dust; domestic sewage is likely to cause water pollution; construction machinery noise near the site may have impact on residents' life; frequent travel by construction vehicle will cause certain traffic congestion; construction process need to avoid inflammable and explosive goods to prohibit fire explosion risk. But the main risk during operation period is disinfectant chlorine leakage. Environmental factor identification are shown in **Table VII-4**.

Table VII-4 Identification of Environmental Impact Factors

Engineering Characteristics / Impact Factor		Construction Period					Operation Period	
		Construction	Site Clearance	Material Transport Stacked	Pass-Through Works	Waste Water Discharge	Solid Waste	Chemical Leakage Risk
Natural Environment	Ambient Air	-○	-☆	-○			-○	-☆
	Surface Water	-○	-○		-○	-○	-○	
	Groundwater						-○	
	Acoustic Environment	-☆	-○	-☆			-☆	
Ecological Environment	Surface Vegetation		-☆		-☆	-○		
Social Environment	Economic Development	+☆		+○	-○			-★
	Employment Expansion	+○	+○	+○	+○			
	Occupational Health	-○	-○			-○	-○	-★
	Quality Of Life				-☆	-○	-○	-☆
	Landscape	-☆	-☆		-☆			
	Respiratory Disease	-☆			-☆			

Note: +Positive Impact; - Negative Impact; ★ Large Impact; ☆ General Impact; ○ Small Impact

147. **EIA factor selection.** According to the project content, environment characteristics, WB requirements, as well as the control indicators listed in national and local regulations on environmental protection, the project EIA factor screening results are shown in **Table VII-5.**

Table VII-5 EIA factor Selection Result

Environmental Elements			Engineering Emission Factor	Evaluation Factors
Ambient air	During construction	Impact analysis	Dust, construction mechanical emission	Dust, NO_2
Surface water environment	During construction	Impact analysis	Sewage wastewater uses public sanitation facilities; waste water after cleaning and pressure test; impact on water when crossing the river	PH, CODcr, SS and etc
groundwater environment	Status investigation		Chemical warehouse seepage control engineering in WSP	-
Vibration and noise	During construction	Residence near sensitive spots, construction personnel	Construction machinery noise	Level A acoustic standard; The occupational health
	During Operation	Noise of waterworks to residents Nearby and workers	Noise from WSP and pumping station equipment during operation	Level A acoustic standard
Ecological environment	Impact analysis		——	Vegetation, water loss and soil erosion
Solid waste	Impact analysis		During construction: building materials, temporary earthwork pile, domestic garbage	The rationality of the temporary piled up and earthwork usage, construction waste disposal and domestic garbage collection
			During operation: domestic garbage by water pump station operation workers, and sludge generated by water treatment	Sludge agricultural and forest use
Environmental risk			During Operating: chlorine leak	Safety impact analysis for life and property
Social impact			During construction: traffic congestion, commerce, schools, and residents' quality of life on frontage area. During Operation: improvement of water quality, water quantity.	Comprehensive impact analysis

148. **Earthwork balance**. According to the Feasibility Study Report, the project excavation volume is 5.328 million m^3 with filling amount of 4.398 million m3, borrowing amount 70,000 m^3, and remaining of 1 million m^3. According to the five EIA reports and the Environmental Management Plan, the remaining earthwork will be used for backfill near the construction site and road engineering foundation.

Table VII-6 Earthwork Balance Table (in 10,000 m^3)

City	Project	Excavation	Filling	Borrowed	Abandoned	Abandoned Direction
Shenyang	Total	98.1154	93.2096	0	4.9058	Refill for construction site and roadway
Anshan	Valve pipe network reconstruction project	15.8180	15.1009	0	0.7	

	Secondary pumping station renovation	10.5786	10.4956	0	0.083	works foundation nearby
	Residential area network reconstruction	8.307	8.2681	0	0.0389	
Fushun	Total	340.0	280.0	0	60.0	
Fuxin	Municipal water supply pipe network project	45.0	18.0	7.0	34.0	
	Residential area water supply reconstruction	10.0	10.0[3]	0	0	
Gaizhou	WWTP	1.2	1.2	0	0	
	Raw water pipeline	2.2	2.0	0	0.2	
	Water pipeline	1.6	1.5	0	0.1	
	Total	**532.819**	**439.804**	**7**	**100.027**	

Source: the EIA Institutes

149. **Domestic wastewater and garbage from construction workers**. According to the EIA estimates, the number of five project cities construction workers is 690 at maximum. Since most of the construction sites are in urban area, most of construction workers will live in the existing renting houses and use the existing drainage facilities in residential area and the public rest rooms near construction sites. Take 40 L/day/people as daily domestic water usage amount for construction workers, 0.5 kg/day/people as domestic garbage produced. Sewage is discharged through the municipal sewage pipe network into the existing sewage treatment plant and then discharged, there is no big impact to the surface water environmental. The total domestic garbage production in five project cities by construction workers is 0.345 t/day, which will be collected and disposed by local sanitation department to the existing garbage landfill site for sanitary landfill.

Table VII-7 Domestic Sewage and Garbage Produced by Construction Workers

City	Number of Workers	Water Usage (m3/d)	Sewage(m3/d)	Domestic Garbage (t/d)
Shenyang	250	10	8	0.125
Anshan	140	5.6	4.48	0.07
Fushun	100	4	3.2	0.05
Fuxin	50	2	1.6	0.025
Gaizhou	150	6	4.8	0.075
Total	690	27.6	22.08	0.345

Source: EIA Institutes

150. **Demolition waste disposal**. According to EIA institute's estimation, including those to be demolished from the 9 pumping stations renewal work proposed in April 2017 by Fuxin WSC, the project pump station and pipeline constructions will generate about 3,000 tons of demolition waste of iron and ductile iron pipes, 10,000 tons of waste PE pipe, 84,000 wasted water meters, and 45 wasted pump electric motors. Waste pipe and water meters can be categorized as general solid waste, which is nonpoisonous and harmless, and can be recycled through each city recycling system in line with the 3R principle (reduce, recycle, reuse). However, the discarded electric motors contain small amounts of lead, cadmium, chromium, polyvinyl chloride, halide flame retardants and poisonous and harmful material such as PCB, which are hazardous waste. Waste like these will be sent to Liaoning Environmental Protection Engineering

(Shenyang) Center for Hazardous Waste Disposal, which is a qualified hazardous waste disposal institute, for free-pollution disposal.

151. **Pipeline crossing engineering (railway and river)**. According to Feasibility Study, this project will be have 38 pipelines crossing the railway and river (see **Table VII-8**).

Table VII-8 Pipeline Crossing Engineering

City	Location	Crossing Rail/River	Crossing Length (m)	Construction Method
Shenyang	Beiyi Road	Railway	6m	Pipe jacking
	Zhujiang Street	Railway	30	Pipe jacking
	Yalujiang Street	Abandoned Railway	6	Pipe jacking
	Dongxin Road	Abandoned Railway	6	Pipe jacking
	Yingchun Bei Street	Railway	6	Pipe jacking
	South No.11 Middle Road	Weigong Canal (sewage receiving river)	22	Stay tube
	South No.12 Middle Road	Weigong Canal (sewage receiving river)	34	Stay tube
	Xijiang Bei Street	Unknown river	6	Stay tube
	Daoyi Bei Avenue	Puhe River, Class V Waterbody	35	Stay tube
	Nanyanghu Street	Xihe River, Class V Waterbody	40m	Stay tube
	Heping Nan Street	Nanyun River, Class V Waterbody	50m	Stay tube
	Dongxin Road	Huishan Canal (sewage receiving river)	15	Stay tube
	Yingchun Street	Shenfu Canal, Class V Waterbody	40	Stay tube
	Dingxiang Street	Shenfu Canal, Class V Waterbody	40	Stay tube
	Yingchun Bei Street	Huinan Canal, Class V Waterbody	15	Stay tube
Anshan	Chuangye Road	Changda Railway	2m	Stay tube
	Dagushan Pump Station	Wanshui River	30m	Stay tube
Fushun	13 Locations	Railway	-	Stay tube
	4 Locations	Riverway	-	Pipe jacking
Fuxin	2 Locations	Jing, Shen High-speed Rail	15+15m	Pipe jacking
	2 Locations	Jiuyingzi River, Qinghe River	20+24m	Pipe jacking

Source: the updated FSRs

152. In order to reduce the impact on environment and transportation, this project adopts the stay tube (pipe-pulling) and pipe jacking (non-excavation technology) way crossing the railway and river. Pipeline will be under the rail and river by certain depth, it won't cause pollution to soil and water, and through accurate positioning, where will be the advantages of no tearing up the road, no blocking traffic, small disturbance, low environmental impact without limited by the season; In addition, threr is no construction impact on aquatic creatures and water quality. It is an environmental friendly way of pipeline crossing. However, it will still produce a certain amount of non-toxic wastes and sludge, which can be used for building and road foundation backfill. Pipeline construction site will set sludge pools, strict seepage control measures will be taken with composite lining, and it will be compacted by machinery (stratum soil compaction). Then it will use synthetic material lining as the underlying, and the high density polyethylene with thickness of no less than 1.5 mm, the seepage coefficient not more than 10-12 cm/s. Finally, 5 cm clay will be laid on the artificial lining cover, and adopt mechanical compaction. After the

above treatment the seepage coefficient of the sludge pool which is smaller than 1 x 10-7 cm/s meets the requirements of anti-seepage.

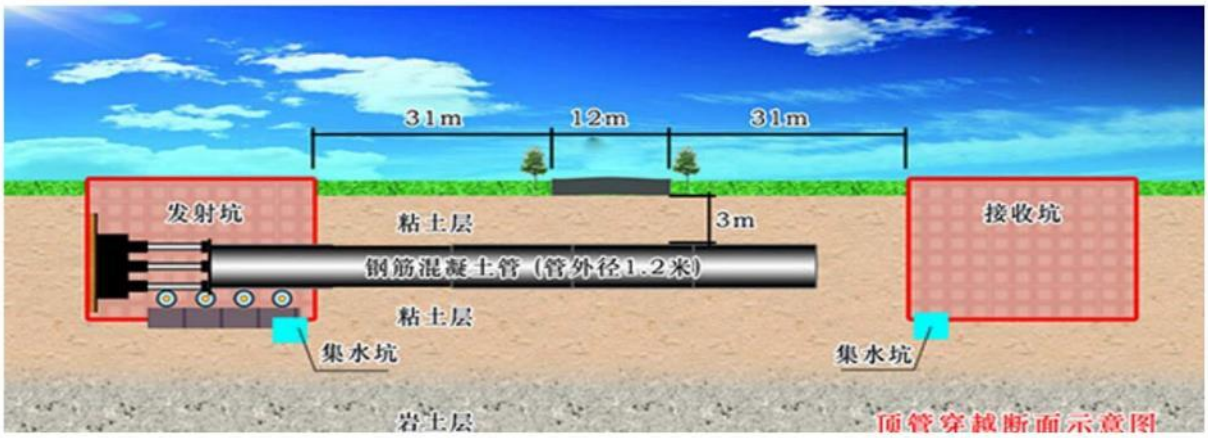


Figure VII-1 Pipe Jacking Construction

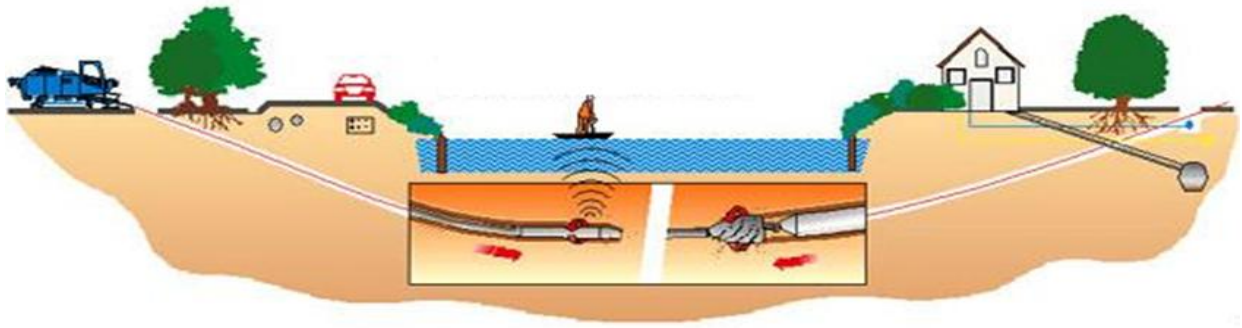


Figure VII 7-2 Pipe-pulling Construction

Figure VII -3 Stay Tube Machinery

153. **Traditional network slot construction method**. The objective of most of the pipeline construction still adopts the traditional excavated construction method, its construction technological process and production of nodes as shown in figure 7-4;Appropriate environmental mitigation measures are shown in Table VII-9.

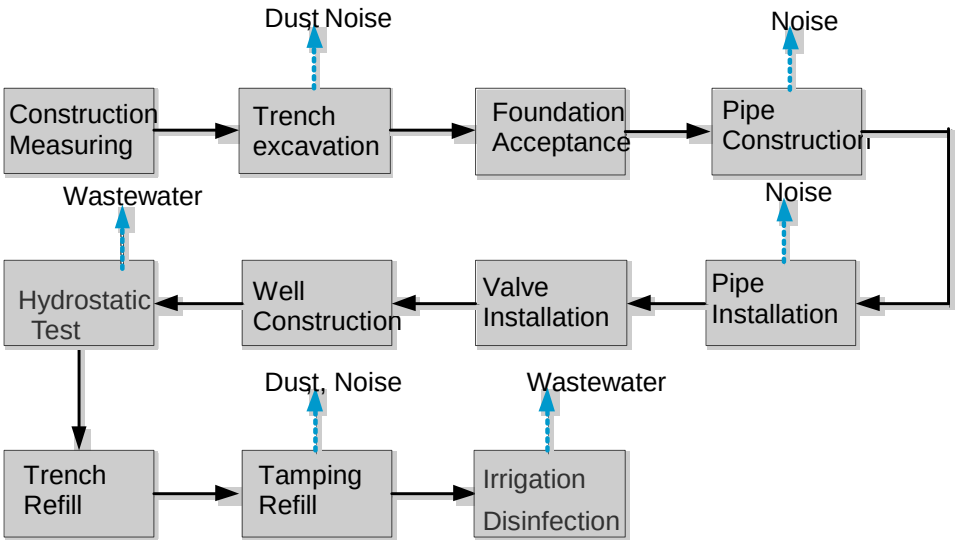


Figure VII-4 Slot Construction Technology and Waste Production

154. **Liquid chlorine leak risk during operation of WSPs and emergency response plans**. The project includes the reconstruction of two existing WSPs (Anshan and Fuxin). The disinfectant adopts liquid chlorine, the storage and transportation of liquid chlorine exist potential environmental risks, especially for liquid chlorine cylinder leakage accident, the harm will be large. Therefore, the risk factors in the process of storage and transportation of liquid chlorine leakage is poisoning accident. In the process of storage and chlorine disinfection, the main accident that may exist will be the pipeline valve leakage, ejector equipment failure, and operation error, etc. The most serious accident will be leak valve damage. The accident risk prevention and mitigation measures include:

155. **Measures to prevent accidents in the process of transportation**: liquid chlorine belongs to the dangerous goods, in the process of transportation, special attention should be paid to ensure safety. Shipment should designate person, vehicle. If leaking is found in the process of transportation, active measures should be taken to deal with and prevent further expansion. After cutting off the leak source, the accident should be timely reported to the local public security and relevant departments. If no effective measures can be taken, one should immediately report to the local public security and relevant departments to request support.

156. **Safety measures in the process of operation**: to strengthen the training of operators, improve operation skills, follow the operating procedures, the bottle on two on-line valve should be perpendicular to the ground during installation of liquid chlorine steel cylinder, chlorine gas bottle is on top, liquid chlorine valve is on bottle, the output to the evaporator pipe connected to the valve of liquid chlorine. When multiple chlorine bottle supply at the same time, keep each chlorine bottle temperature the same to avoid high temperature container gas cause pressurization, there is high quality demand of electrical components and pipeline fittings of evaporator, so regular maintenance and the management level should be improved regularly.

157. Chlorine workshop should configure chlorine leakage alarm device, emergency supplies box and protective masks, including 2 to 3 sets of the onboard oxygen masks, etc., and equip with mechanical forced ventilation facilities and chlorine gas spray processing equipment to ensure the timely report to the police after the accident, emergency handling, ventilation and treatment. Accident emergency measures including:

i). After the liquid chlorine leaking, the on duty personnel should immediately wear respirator, check the specific leak location, and report to the WSP scheduling, chlorine maintenance gang and the leadership as soon as possible;

ii). After receiving the report, the leader should immediately organize maintenance personnel to conduct emergency maintenance, evacuate irrelevant personnel, rescue people, set up the isolation zone, and work with emergency rescue team to follow unified deployment by the company rescue and relief headquarters.

iii). if it is chlorine bottles leaking, the on-duty personnel must wear work clothes, gloves and mask or respirator, and turn the leaks to upper part and put it into gas space;

iv). If it is fusible plug leakage, bamboo sticks or stopper plugging can complete plugging treatment;

v). If it is leakage of cylinder valves, the personnel should immediately tighten hexagonal nut;

vi). If it is bottle weld leakage, the personnel should line it with rubber mat or a piece of iron banding. It is strictly prohibited to leak water directly, lye (sodium hydroxide and potassium hydroxide solution) or water spray should be conducted around to leak to absorb chlorine evaporated into the air and prevent the spread expansion to cause the personnel outside the exclusion zone poisoning.

vii). Before the arrival of the 120 emergency, based on the status, the severe poisoning injured workers should be moved quickly to fresh air, if the heart stops, it is essential to immediately perform artificial respiration and chest outside heart compression.

158. The injured first aid measures include: i) Skin contact: immediately remove contaminated clothes and rinse with water for medical treatment; ii) Eye contact: mention eyelid, irrigate with flowing water or normal saline; iii) Inhalation: quickly fled the scene to fresh air place, if heart stops, immediately perform artificial respiration and chest outside heart compression.

159. Operating personnel protective measures include: i) Body protection type adhesive wear the mask gas-protection clothing and rubber gloves; ii) Respiratory protection: it recommends to wear air respirator when higher concentration in the air or oxygen respirator, oxygen breathing apparatus must be worn when emergency rescue or evacuation; iii) Eye protection: respiratory protection has been made in protection; iv) Smoking, eating and drinking is forbidden in job site. After work, it is important to maintain good health habits to shower and change clothes, supervision should be conducted when one is getting into the jar, restricted space, or other high concentration area.

VII-4 Anticipated Impacts and Mitigation Measures

160. Potential project environmental impacts and their mitigation measures are summarized in Tables VII–4. Mitigation measures will be incorporated into detailed design, bidding documents, construction contracts and operational management manuals, which will be implemented by the design institutes, contractors, CSCs, LUCRPO and IAs, with technical support from the LIEC and under the supervision of the municipal and district EPBs. The effectiveness of these measures will be evaluated based on environmental inspections and monitoring to determine

whether they should be continued, improved or adjusted. The mitigation measures aim to: (i) mitigate environmental impacts; (ii) achieve compliance with PRC environmental laws, regulations and standards and the World Bank Safeguard Policy; and (iii) protect environmental resources and ecosystems, and maximize social-economic and environmental benefits.

Table VII-4 Potential impacts and mitigation measures for project construction

Item	Potential impact	Mitigation measure	Responsibility	
			Implement	Supervise
Preconstruction Phase				
Detailed design stage	Process and equipment of WSPs	• Design low-carbon water supply system including (i) high efficiency pumping with variable speed drivers, (ii) water leak detection, repairing and management (equipment and mechanism); (iii) water supply system automation for energy saving (smart water supply management system), and (iv) accurate metering and monitoring for water consumption. • Design water quality monitoring instruments in the WSCs to monitor 106 parameters listed in the national Drinking Water Quality Standard of GB5749-2006. • All WSP sites and pipeline routes in the detailed designs shall be carefully selected to avoid or minimize potential adverse impacts on the environment and surrounding communities. • According to the situation that the pipeline will pass through railway and river, non-exaction works as pipe jacking and stay tube will be conducted to minimize the environmental and traffic impact	DI	LUCRPO WSCs, WRBs
	Designate Environment Officer	• Designate a well-trained environment officers/staff in LUCRPO and five IAs	LUCRPO	EA, EPB, WB
	Update EMP	• Update mitigation measures defined in this EMP based on final detailed design, submit to the city EPBs and the WB for approval.	EA Institute, IAs, LUCRPO	Municipal EPBs, WB
	LARP	• Incorporate updated land acquisition and resettlement plan (LARP) in detailed design.	IAs, LUCRPO	BCA, BLR, LARO
	External and compliance environmental monitoring	• Prior to construction, engage the local EMSs for compliance monitoring. • Prepare a detailed work plan, based on the environmental monitoring program (Table A.5).	LUCRPO, IAs	Municipal EPBs, WB
	Technical assistance	• Include environment provisions in the TOR for selecting the LIEC.	LUCRPO, IAs	WB
	Bidding and contract documents	• Include environment requirements in the bidding documents for selection of DI, contractors and loan implementation TA consultants; • Include environmental mitigation and	LUCRPO, IAs	EPBs, WB

Item	Potential impact	Mitigation measure	Responsibility	
			Implement	Supervise
		monitoring clauses defined in the EMP in the contracts with DI, contractors and loan implementation TA consultants.		
	EMP training	• LIEC, and/or invited environment specialists and/or officials from provincial and municipal EPB, provide training on construction environmental management and implementation and supervision of environmental mitigation measures to contractors and CSCs.	LUCRPO, LIEC, IAs	EPBs, WB
	EMP and supervision manual	• Prepare environmental operation and supervision plans/manuals for all construction activities. These plans will need to fulfill the requirements of this EMP.	Contractors, CSCs	LUCRPO, IAs, EPB, LIEC
	Internal environmental monitoring and supervision plan	• Prepare an internal environmental monitoring plan to meet the requirements defined in the EA and the EMP. These plans will need to fulfill the requirements of this EMP.	Contractors, CSCs	LUCRPO, IAs, l EPBs, LIEC
	Establish GRM	• Establish a Project Public Complaints Unit (PPCU) in LUCRPO. • Provide training for PPCU members and GRM access points. • Disclose the PPCU's phone number, fax, address, and email to the public on the district EPB's website and on information boards at each construction site.	LUCRPO, IAs	EPBs, LIEC, WB
	Onsite EHS officer	• After contract award and prior to start of construction, assign an onsite EHS officer for each contractor.	Contractors	LUCRPO, IAs, CSCs, LB
	Resettlement, Economic displacement	• Establish a resettlement office comprising local government officials to manage the land acquisition and resettlement process. • Ensure resettlement activities are reasonably completed before construction starts. • Ensure implementation of the project social development action plan.	IAs, LARO,	LUCRPO, EA, LB, BCA
Construction Phase				
Soil and geology	Soil erosion	• Stabilize compacted pipe trenches, and other erosion-prone working areas. • Earthwork disturbance areas must be stabilized within 7 days after earthwork completion. • Minimize active open excavation areas during water supply pipeline trenching activities (Maximum trench length will be 300 m in accordance with the domestic EA report); use appropriate compaction techniques for pipe trench construction. • Provide temporary detention ponds or	Contractors, CSCs	LUCRPO, IAs, EPBs, LIEC

Item	Potential impact	Mitigation measure	Responsibility	
			Implement	Supervise
		containment to control silt runoff. • Construct intercepting ditches and drains to prevent runoff entering construction sites, and divert runoff from sites to existing drainages. • Strip and stockpile topsoil, and cover temporary soil stockpiles. • Limit construction and material handling during periods of rains and high winds. • Properly re-vegetate or repave disturbed surfaces, such as compacted pipeline trenches and the WSPs after completion of constructions. • Appropriately locate construction workers' camps and storage areas to minimize land area required and impact on soil erosion. • Implement soil erosion inspection and monitoring program. Internal inspection will be conducted by contractors and CSCs. Monitoring results will be submitted to LUCRPO and IAs, and city EPBs. These will serve as basis for project implementation progress reports and acceptance of construction.		
	Soil Contamination	• Properly store petroleum products, hazardous materials and wastes on impermeable surfaces in secured and covered areas. • Remove construction wastes from the site to approved waste disposal sites. • Establish emergency preparedness and response plan (Spill Management Plan). • Provide spill cleanup measures and equipment at each construction site. Require contractors to conduct training in emergency spill response procedures.	Contractors, CSCs	LUCRPO, IAs, EPBs, LIEC
	Spoil disposal site management and rehabilitation	• Manage spoil disposal sites in accordance with the approved plan by the city EPBs. • Rehabilitate and restore the spoil disposal sites in accordance with approved plans. • Conduct regular internal supervision and periodic external monitoring (licensed soil erosion institute) of the spoil disposal sites. • Conduct project completion audit to confirm that the spoil disposal site was rehabilitated in accordance with the approved rehabilitation plan and government regulations. Hold contractors liable in case of non-compliance.	Contractors, CSCs	LUCRPO, IAs, EPBs, LIEC
Reservoir/ raw water quality	Water quality and hydrology	• Earthworks near the surface water (such as Anshan water intake pumping station) will be accompanied by measures to minimize sediment runoff into the reservoirs, including sediment traps.	Contractors, CSCs	LUCRPO, IAs, LIEC, WSCs, EPBs, WRBs,

Item	Potential impact	Mitigation measure	Responsibility	
			Implement	Supervise
		• The discharge of construction wastewater to the reservoirs or nearby surface waters will be prohibited. • Fuel storage, maintenance shop and vehicle cleaning areas will be stationed at least 500 m away from the reservoirs/surface waters. • A water monitoring program has been developed and will be implemented to assess construction impacts.		
Ambient Air	Dust and emission generated by construction activities	• Spray water on construction sites and earth/material handling routes where fugitive dust is being generated. • When repaving the road after pipeline works, locate asphalt mixers at least 500 m downwind from the nearest residential areas and other sensitive receptors. • Pay particular attention to dust suppression near sensitive receptors. • Store petroleum or other harmful materials in appropriate places and covering to minimize fugitive dust and emission. • Cover materials during truck transport, in particular, the fine material, to avoid spillage or dust generation. • Ensure emissions from vehicles and construction machineries comply with PRC standards GB18352-2005, GB17691-2005, GB11340-2005, GB2847-2005, and GB18285-2005.	Contractors, CSCs	LUCRPO, IAs LIEC, EPBs
Noise	Noise generated from construction activities	• Ensure noise levels from equipment and machinery conform to PRC standard of GB12523-90. Properly maintain construction vehicles and machineries to minimize noise. • Apply noise reduction devices or methods for WSP foundation work where piling equipment is operating within 300 m of villages, schools, hospitals and residential areas. • Locate sites for rock crushing, concrete-mixing, and similar activities at least 1 km away from sensitive areas. • To reduce noise at night, restrict operation of machinery generating high levels of noise (e.g. piling) and movement of heavy vehicles along urban and village roads between 20:00 and 06:00 in accordance with PRC regulations. • Take special caution at construction sites close to sensitive sites. When construction activities are unavoidable during school seasons, the use of heavy equipment will be restricted to weekends and non-class hours.	Contractors, CSCs	LUCRPO, IAs, LIEC, EPBs

Item	Potential impact	Mitigation measure	Responsibility	
			Implement	Supervise
		• For construction sites near sensitive receptors, place temporary hoardings or noise barriers around noise sources. • Monitor noise at sensitive receptors. If noise standards are exceeded, equipment and construction conditions shall be checked, and mitigation measures shall be implemented to rectify the situation. • Conduct monthly interviews with villagers and residents adjacent to construction sites to identify community complaints about noise and seek suggestions to adjust work hours of noise-generating machinery.		
Vibration	Vibration generated by piling	• In consultation with local residents and/or other property/landowners, identify structures which may be most vulnerable to vibration impacts. • Cleary demarcate such structures to avoid hazards to human safety. • Coordinate with residents on the timing of heavy machinery work close to these structures. • Prohibit piling and compaction operations at night.	Contractors, CSCs	LUCRPO, IAs, LIEC, EPBs
Solid Waste	Solid waste generated by construction activities and from workers' camps	• Provide appropriate waste collection and storage containers at locations away from the reservoirs or sensitive receivers. • Reach agreement with municipal waste collection services for regular collection of domestic waste prior to construction. • Hold contractors responsible for proper removal and disposal of any significant residual materials, wastes and contaminated soils that remain on the ground timely during and after construction. • Any planned paving or vegetating shall be done as soon as the materials are removed to protect and stabilize the soil. • Burning of waste is strictly prohibited. • Provide sufficient garbage bins at strategic locations and ensure that they are protected from birds and vermin, and emptied regularly (using the municipal solid waste collection systems).	Contractors, CSCs	LUCRPO, IAs, LIEC, EPBs
Flora and Fauna	Protection of vegetation	• Protect existing vegetation nearby construction sites. • Properly backfill, compact, repave and revegetate pipeline trenches after construction. • Protect existing trees and grassland during WSP and pipeline construction. Where vegetation must be disturbed, revegetate immediately after construction. • Remove trees or shrubs only as a last	Contractors, CSCs	LUCRPO, IAs FBs, EPBs, LIEC,

Item	Potential impact	Mitigation measure	Responsibility	
			Implement	Supervise
		resort if they impinge directly on permanent works or approved necessary temporary works. • In compliance with the PRC's forestry law, undertake compensatory planting of an equivalent or larger area of affected trees and vegetation. • Identify, demarcate and protect sites where small animals, reptiles, and birds of common species live such as vegetated areas, trees, and along riversides. • Utilize native plant species of local provenance for replanting in the WSPs and along the roads if the pipeline construction damaged existing vegetation.		
Socio-economy	Physical Cultural Resources	• Establish chance-find procedures for physical cultural resources. If an artifact is unearthed during construction, work will be stopped immediately. The BCR, IAs and LUCRPO will be promptly notified. Construction will only resume after permission of the appropriate authority.	Contractors CSCs	IAs, LUCRPO, LIEC, BCR
Health and safety	Community health and safety	• Traffic management. A traffic control and operation plan will be prepared, to be approved by the Traffic Management Bureau before construction. The plan will include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings, selecting transport routes to reduce disturbance to regular traffic, reinstating roads, and opening them to traffic as soon as the construction is completed. • Underground facilities survey and protection. Construction activities are planned to minimize disturbances to utility services. Three-dimensional detection of underground facilities will be conducted before construction where appropriate. • Information disclosure. Residents and businesses will be informed at least 2 weeks in advance, through media of the construction activities, given the dates and duration of expected disruption. • Public signs will be placed at construction sites, warning people of potential dangers such as moving vehicles, hazardous materials, excavations, and raising awareness on safety issues. All sites will be secured, through fencing if appropriate.	Contractors CSCs	IAs, LUCRPO, LIEC, TMBs
	Occupational. health and safety	• An environmental, health and safety officer (EHSO) will be appointed by each contractor to implement and supervise the	Contractors, CSCs	LUCRPO, IAs, LBs, EPBs,

Item	Potential impact	Mitigation measure	Responsibility	
			Implement	Supervise
		environmental, health, and safety management plan. • Each contractor will prepare an environmental, health and safety management plan (EHSMP) for construction works, based on this EMP. The EHSMP will include the following: • provide clean and sufficient supply of fresh water, for construction sites and for all camps, offices and workshops; • provide adequate number of latrines and other sanitary arrangements at construction sites and work camps, and ensure they are maintained in a hygienic state; • install and regularly empty garbage receptacles at construction sites and camps; • provide personal protection equipment, e.g. safety boots, helmets, gloves, protective clothing, goggles, ear protection, in accordance with relevant health and safety regulations for workers. • Prepare an emergency response plan to address accidents and emergencies, including environmental and public health emergencies associated with hazardous material spills and similar events. Submit to EPB for review and appraisal. Emergency phone link with hospitals in the district will be established. A fully equipped first-aid base in each construction camp will be organized; • Maintain a record management system. It will include documenting and reporting occupational accidents, diseases, and incidents. Records will be reviewed during compliance monitoring and audits. • Ensure that occupational health and safety matters are accorded a high degree of publicity to all persons accessing construction sites. Posters will be displayed prominently in relevant areas of the site. • Train all construction workers in basic sanitation, general health and safety matters, and specific hazards of their work. Implement SITs/HIV/AIDS and other communicable diseases awareness and prevention program to target the local community and construction workers.		LIEC,
Operation				
Water source Protection	Accidental chemical spill, resulting in contamination of water sources	• Emergency response to switch to other WSP(s) through the distribution network for the safe water supply and shut down the polluted WSP. • Implement the emergency response mechanism.	WSCs,	WRBs, EPBs

Item	Potential impact	Mitigation measure	Responsibility	
			Implement	Supervise
	Pollution to the reservoirs/ water source	• Measures to identify and control pollution sources to be identified under the project Component 2. • Under project component 2 (water quality monitoring instruments procurement), strengthen water quality monitoring at water sources/reservoirs. • Enhance the water treatment process of Coagulation – filtration - chlorination.	WSCs, EMSs	WRB, EPBs
Water Treatment Process	Mechanical or electrical failure of chemical dosing system, resulting in high turbidity	• Use backup coagulant dosing system. • Install and maintain automatic dosing pump with integrated alarm system in the event of failure.	WSCs	WRBs, EPBs
	Use of contaminated coagulant, resulting in contamination of water	• Coagulant must be purchased form approved supplier, demonstrating compliance with national product standard of GB1892-2009.		
	Failure of filtration system, with high turbidity and potential for pathogen breakthrough	• Install and regularly calibrate on-line filtration turbidity monitoring instrument, with alarm system. • Multiple separate filtration units in parallel. • Maintain operational condition of filtration chamber by regular back flush and maintenance.		
	Insufficient or excessive chlorine dosing resulting in pathogen breakthrough or chlorine taste and odor	• Automated chlorine dosing and on-line residual chlorine monitoring to achieve chlorine content of 0.5mg/L to 1.0mg/L (30min after chlorination).		
	Treated water storage: Accidental recontamination of water (through rodents, birds, etc. and groundwater ingress)	• Clean water storage tank will be roofed. Vents and overflows will be meshed. • Storage tank walls will be lined with water proof material. • Frequent inspections and maintenance of the tank.		
	Water supply Pumping failure, power failure, with loss of pressure and risk of re-contamination due to back-siphonage.	• Backup pumps and dual power system will be installed and maintained in good condition. • Inspect backup pumps and dual power system regularly.		
	Pipe burst causing water re-contamination and interrupted service	• Proper pipe material selection. • Identify and implement procedures for operating system to avoid spikes and water hammering. • Implement emergency response action plan, including quick repair of bursts and pipe cleaning and water quality monitoring for the network.		

Item	Potential impact	Mitigation measure	Responsibility	
			Implement	Supervise
Water supply safety	Training and monitoring	• Equip monitoring instruments in the WSC laboratory to analyze 106 parameters of the National Standard for Drinking Water. • Build emergency warning system and equip with water source automatic monitoring systems in the reservoirs. • Ensure WSP staff are well trained on all steps of treatment process, including emergency warning and response actions.		
Solid waste	Solid waste from WSPs' staff and treatment process	• Rubbish and dewatered sludge will be regularly collected, and disposed.	UMB	EPB

Source: the domestic EAs. Key: *BCA- Bureau of Civil Affairs; BCR- Bureau of Cultural Relics; BLM-Bureau of Land Management; CSC-Construction Supervision Company; DI-design institute; EA-Project Executive Agency; EHS-environment, health and safety; EMS- Environment Monitoring Station; EPB-Environment Protection Bureau; FB- Forestry Bureau; GRM-Grievance Redress Mechanism; IA-Project Implementation Agency; LARP- Land Acquisition and Resettlement Plan; LARO- Land Acquisition and Resettlement Office; LB- Labor Bureau; LIEC- Loan Implementation Environmental Consultant; PPCU-Project Pubic Complaints Unit; TA-Project Technical Assistance; WSC- Water Supply Company; WRB- Water Resource Bureau; WSP-Water Supply Plant.*
Source: *Domestic EAs and FSRs, LUCRPO WSC, EPB, WRB and other government divisions.*

VII-5 Estimated Costs for Implementation of Mitigation Measures

161. The estimated cost for implementation of environmental impact mitigation measures nd environmental monitoring during construction period and operation (the first year) is listed in Table VII-10. It is estimated through similar projects' experiences by the five EA units and FSRs. The cost will be adjusted after the project design is completed to be finally determined.

Table VII-5 Estimated costs for implementation of mitigation measures and environmental monitoring

Item			Project City					Province
Type	Phase	Mitigate/Monitoring Item	Shenyang	Anshan	Fushun	Fuxin	Gaizhou	
EP Mitigation Measures	Construction Period	Dust And Gas	50	10	10	31	8	
		Wastewater	10	10	5	2.5	8	
		Noise	15	20	2	11	10	
		Solid Waste	20	15	8	3	30	
		Water And Soil Conservation	35	30	5	36	20	
	Operation Period	Noise	28	80	20	15	20	
		Greening	65	32	5	35	30	
Environmental Monitoring	Construction Period	Air Monitoring	8	6	6	18	5	
		Surface water Monitoring	12	6	6	11.5	5	
		Noise Monitoring	4	5	4	6	4	
	Operation Period	Noise Monitoring	5	5	5	8	5	
Institutional Strenghening	Staff Training		20	15	12	17	5	5.4
	Equipment Procurement		-	-	-	16	-	

Total	272	234	88	210	150	959.4

Source: Environmental Monitoring Units

VIII. Environmental Monitoring, Inspection and Reporting

162. The project environmental monitoring program focuses on the project's area of influence. The program describes the location of monitoring, parameters, time and frequency, implementing and supervising agencies, internal and external monitoring, and estimated costs. A detailed cost breakdown will be provided by the city EMSs when the detailed environmental monitoring programs are prepared at the start of each subproject implementation. Sampling of individual parameters shall comply with the methods provided in the relevant national environmental monitoring standards for air, water, noise, soil, pollutant discharge, and PRC Drinking Water Quality Standard of GB5749-2006. These standards are comparable with the World Bank EHS Guidelines.

163. **Internal environmental inspection and monitoring.** Each contractor and CSC will recruit at least one environmental staff for its internal environmental inspection and supervision during construction. The LUCRPO Environment Officer, supported by the LIEC, will be responsible for internal inspection and overall compliance with the EMP during project construction and the first year of operation. The project city EMSs will be responsible for the environmental monitoring program (i.e. water, air, noise and soil monitoring). The LUCRPO Environment Officer, LIEC and city EPBs will advise and supervise the contractors, CSCs and IAs to ensure that the environmental mitigation measures defined in the EMP are properly implemented. At the start of the project implementation, detailed internal environmental monitoring plans will be prepared by the CSCs, based on the project EMP, and reviewed and approved by the LUCRPO and LIEC.

164. **Compliance monitoring.** The city EMSs will conduct compliance monitoring during both construction and operation, as well as in the event of emergencies. The frequency and scope of the monitoring is described in Table VIII-1. annual monitoring reports will be prepared by the EMSs and then submitted to the IAs, the EPBs and LUCRPO for review.

165. **External monitoring.** In response to the World Bank Safeguard Policy requirements, the environment performance of each project component/subproject will be verified by external experts. The external experts are involved intermittently, and are external to the EA and IAs. The external experts may comprise loan implementation consultants that are not involved in day to day project implementation. The external experts will verify the EMP implementation and environmental monitoring information prepared by LUCRPO and the IAs. In verifying, external experts may conduct their own investigation by visiting the project sites, taking samples and/or conducting site inspections. The external experts will discuss the verification results with LUCRPO and the IAs, suggest corrective actions, and reflect findings in their EMP implementation and environmental monitoring verification reports.

166. **Quality assurance (QA)/quality control (QC) for compliance monitoring.** To ensure accuracy of the monitoring, the QA/QC procedures will be conducted in accordance with the following regulations:

i) Regulations of QA/AC Management for Environmental Monitoring issued by the Ministry of Environmental Protection in July 2006;

ii) QA/QC Manual for Environmental Water Monitoring (Second edition), published by the State Environmental Monitoring Centre in 2001; and

iii) QA/QC Manual for Environmental Air Monitoring published by the State Environmental

Monitoring Centre in 2001.

167. The results of environmental inspection and monitoring will be used to assess: (i) extent and severity of actual environmental impacts against predicted impacts; (ii) effectiveness of the mitigation measures and compliance with environmental standards and regulations; (iii) trends in impacts; (iv) overall effectiveness of EMP implementation; and (v) the need for additional mitigation measures and corrective actions if non-compliance is observed.

168. **Monthly internal reports.** During project construction, monthly environmental progress reports will be prepared by the CSCs and submitted to the LUCRPO and IAs. These will summarize the monthly monitoring and inspection data collected by the CSCs. These reports will present: (i) project implementation status; (ii) mitigation measures implemented; (iii) results of monitoring and inspections, including monitoring data of air, noise and surface water, in particular outlet water qualities from the proposed WSPs; (iv) analysis of monitoring data against relevant standards and the baseline data; v) violations of environmental regulations and standards (vi) any additional mitigation measures required; (vii) any environmental training received; (viii) occupational health and safety (e.g. any accidents); and (ix) any issues and follow-up actions e.g. complaints.

169. **Annual environmental monitoring and progress reports.** LUCRPO will, on behalf of the EA, submit to the World Bank annual environmental progress reports based on the internal and compliance monitoring and external inspections. The reports will include: (i) progress and effectiveness of EMP implementation; (ii) environmental monitoring and compliance; (iii) institutional strengthening and training; (iv) public consultation; and (v) any problems encountered during construction and operation, and corrective actions undertaken. Information on progress of the associated facilities which are relevant as part of the environmental assurances under the project, will also be included. The LIEC will help LUCRPO prepare these annual reports. The LIEC will also submit a verification report to the World Bank, which will confirm project compliance with the EMP and PRC laws, regulation and standards, and identify any implementation issues and corrective actions.

170. **Report of environmental acceptance monitoring and audit.** No later than one month after completion of construction work, the IA(s) will collect data/reports from contractor(s) and CSC(s), and submit construction completion reports to LUCRPO and the district EPB. The report will indicate the timing, extent, and effectiveness of the completed mitigation and maintenance activities, and point out the need for further mitigation measures and monitoring during operations. Within two months after project completion, environmental acceptance monitoring and audit reports of project completions will be (i) prepared by the EMS in accordance with the PRC Regulation on Environmental Check-and-Acceptance of Project Completion (MEP, 2001), (ii) reviewed for approval by the city EPBs, and (iii) finally reported to The World Bank by LUCRPO and the LIEC.

171. **The World Bank safeguard review mission.** At least once a year, a World Bank safeguard mission will visit the project sites to review project compliance with the EMP, including review of monitoring data, status of EMP implementation, and performance of the public consultation.

Table VIII-1 Environmental Reporting Plan

Phase	From	To	Reporting
Construction			
Internal monitoring report	CSCs	IAs	Monthly
Compliance monitoring report	City EMSs	LUCRPO, IAs, EPBs	Semi-annual
Semi-annual progress report	LUCRPO,	The World Bank	Semi-annual

	LIEC		
EMP completion report	CSCs, Contractors	LUCRPO, IAs, LIEC	1 month after project completion
Environmental acceptance report	EMS	City EPBs, LUCRPO, IAs, EA, The World Bank	2 months after project completion
Operation (first year of operation)			
Internal monitoring report	IAs	EPBs, LUCRPO,	Semi- annual
Compliance monitoring report	EMS, LIEC	LUCRPO, IAs, EPBs, EA, World Bank	Semi-annual

Source: discussion with the EA Institutes

Table VIII-2 Environmental Monitoring Program

Subject	Parameter	Location	Frequency	Implement	Supervise	Applicable standard	Action if exceeded standard	Budget (xCNY10^4)
Construction								
Reservoir water quality	pH, SS, NH_3-N, oil, COD_{cr}, BOD_5, TP, total coliforms	Water sources, reservoirs, and the water intake points of the WSPs	Once a month	EMSs	WSCs, EPBs	Grade II of Surface Water Quality Standard (GB3838-2002)	i)immediately monitor the water quality to identify pollution source; ii) take enforcement action to stop pollution and investigate responsibility	
Air	Inspect dust mitigation measures and maintenance of vehicles and construction equipment	Visual inspection at all construction sites	Internal Monitoring: at least once a month External Monitoring: at least twice per year	CSC LIEC, EMSs	IAs IAs, LUCRPO, EPB			Included in construction supervision contract Included in loan implementation TA contract
	PM10, PM2.5, NOx	All construction sites (at least one point upwind, two points downwind) and sensitive receivers nearby .	Compliance Monitoring: twice per day for 3 consecutive days, twice per year	EMSs	IAs, LUCRPO, EPB	Grade II of Ambient Air Quality Standard (GB3095-1996).	i)immediately monitor to identify the reason for exceeded standard; ii) ensure contractor to take effective mitigation measures; and iii) ensure CSC to strengthen supervision.	
Noise	LAeq	Boundaries of the WSPs, and sensitive receivers near the pipeline construction routs and pumping station sites.	Compliance monitoring: twice per day (once in day time and once at night time) for 2 consecutive days, once every 2 months.	EMS	LUCRPO, IAs, EPB	Grade I of Environmental Quality Standard for Noise (GB3096-2008) for the WSP sites; Grade II and Grade 4a standards for the pipeline routes	i) Endure contractor to take effective measures to control noise source; and ii) ensure CSC to strengthen supervision; iii) stop noisy construction machineries operation during nighttime.	

Subject	Parameter	Location	Frequency	Implement	Supervise	Applicable standard	Action if exceeded standard	Budget (xCNY10^4)
Solid Waste	Garbage from work-camps and construction waste at construction sites	Visual inspection at all construction sites and work-camps	Internal Monitoring: Monthly. External Monitoring: Twice per year	CSCs LIEC, EMSs	IAs, LUCRPO LUCRPO, IAs, EPB	Standard for pollution control on the landfill site for domestic waste (GB 16889-1997)		Included in the construction supervision contract Included in loan implementation TA contract
Soil erosion, vegetation	Quantity of soil erosion and ecologic restoration	Visual inspection at borrow pit and spoil sites	Internal Monitoring: Radom check after rainstorm (rainfall＞50mm) External Monitoring: twice per year, and once after completion of construction	CSCs EMSs, LIEC	IAs, LUCRPO LUCRPO, EPB	i) Technical Specification of Water & Soil Erosion Control for Civil Construction (GB50433-2008); ii) Acceptance Standard of Soil Erosion control for Civil Construction GB/T 22490 -2008; iii) Soil Erosion Control Standard for Civil Construction (GB/T 50434 -2008)	i)immediately inspect the soil erosion situation and identify the reason; ii) take enforcement action to stop soil erosion.	Included in the construction supervision contract Included in loan implementation TA contract
	Compensatory plantings and re-vegetation of spoil disposal sites and construction sites	Visual inspection at all disposal sites and temporary occupied lands	Internal Monitoring: At least four times per year	CSCs	IAs, LUCRPO			Included in the construction supervision contract
			External Monitoring: Twice per year, and once after completion of construction	LIEC	IAs, LUCRPO, EPBs			Included in loan implementation TA contract
Occupational health and safety	Work camp hygiene and safety, availability of clean water and emergency response plans	Inspection at all construction sites and work-camps	Internal Monitoring: Monthly	CSCs	IAs,	Guideline of Occupational health and safety management system (GB/T28002 -2002)		Included in the construction supervision contract
			External Monitoring: Twice per year	LIEC	City Health Bureau			Included in loan implementation TA contract
Subtotal								
Operation Phase								
Water quality	Temperature, pH, SS,	Center of the three	Once every	EMSs	WSCs,			

Subject	Parameter	Location	Frequency	Implement	Supervise	Applicable standard	Action if exceeded standard	Budget (xCNY10^4)
of the reservoirs/ water sources	NH_3-N, oil, COD_{cr}, BOD_5, TN, TP, total coliforms, NO_3-N, DO, SS, Cr_6+, dimethoate, dichlorphos, dipterex	reservoirs, and the water intake points of the WSPs	2months		EPBs			
Noise	LAeq	The boundaries of all WSPs and pumping stations, and sensitive receivers nearby the WSPs and pumping station	Compliance Monitoring: Twice per day (once in day time and once at night time) for 2 consecutive days, semiannually.	EMS	LUCRPO, IAs, EPB			
Vegetation	Trees and vegetation survival and coverage rate	Reforestation areas and spoil disposal sites	Internal Monitoring: Spot check, twice per year	FB, IAs	EPB, Forestry Bureau			Included in FB's operation budget
Soil erosion	Soil erosion situation, turbidity increase in the reservoirs during rainy season	on the catchment areas of the reservoirs, in particular the reforestation areas, and the three reservoirs	Internal Monitoring: once a year	WRB	Municipal WRB, EPB			Included in the WRB's operation budget
			External Monitoring: once a year	LSMI	Municipal WRB, EPB			
Subtotal								

Source: the domestic EAs. Key: BOD_5 - 5-day biochemical oxygen demand; COD_{cr} - chemical oxygen demand; CSC- construction supervision company; EMS - environmental monitoring station; EPB - environmental protection bureau; IA – Project Implementation Agency; LA_{eq} = equivalent continuous A-weighted sound pressure level; LIEC=Loan Implementation Environment Consultant; NH_3-N = ammonia nitrogen; NOx = nitrogen oxides; $PM_{2.5}$ = particles measuring 2.5μm or less; LUCRPO = the provincial project management office; SS = suspended solids; TSP = total suspended particle; WRB- Water Resource Bureau; WWTP=wastewater treatment plant.

IX. GRIEVANCE REDRESS MECHANISM

172. **Background.** In the PRC, under Decree No. 431 Regulation on Petition Letters and Petitioner (State Council, 1 May 2005), a complaint acceptance mechanism is required at all levels of government, and which also protects complainants from retaliation. Under Temporary Act of Environmental Impact Assessment of Public Participating (Ministry of Environmental Protection, No.28 Document, 2006), it is needed to establish Grievance Redress Mechanism (GRM) and protect petitioner, agencies are required to implement a hotline number and email address to receive complaints and/or queries of project activities. The hotline and email address related to environmental protection shall be managed by designate staff in regarding city and district.

173. Under current general practices in Liaoning Province, as in other parts of the PRC, persons affected by construction generally first report to the contractors and IAs directly, or through their community committees. If the issue is not dealt with satisfactorily, the EPBs, which takes the leading role in addressing public concerns for the environment, then consults with the project owner or contractor to address the issue. This process is usually time-consuming. The major weakness of this system is (i) the lack of a project-specific unit to address grievances, and (ii) no specific timeframe for addressing grievances (the processing period usually takes too long and resulting to great complaints by the public).

174. **Project-specific Grievance Redress Mechanism.** A project Grievance Redress Mechanism (GRM) was developed by LUCRPO, IAs, and domestic EIA institutes, The GRM is a joint mechanism for the social and environmental aspects of the project. The GRM addresses the World Bank safeguard requirement to provide a platform for addressing any community concerns. It is designed to enable open channels for effective communication, identify, avoid, and mitigate any adverse impacts on potential affected peoples (APs) caused by project implementation and operations, and establish trust and respect between LUCRPO, IAs and contractors with the local communities. The GRM will be accessible to all members of the community, including the poor and vulnerable, women, children, and ethnic minorities. Multiple points of entry, including face-to-face meetings, written complaints, telephone conversations, or e-mail, are included in the GRM. Opportunities for confidentiality and privacy for complainants will be honored where this is requested, and in other cases if regarded as important. The project GRM comprises the following (Figure IX.1).

i). The LUCRPO and IAs Environment and Social Officers will be responsible for implementation of the GRM. These staff will instruct the contractors and construction supervision companies (CSCs) on how to proceed with any public concerns received. They will coordinate with the district EPB and other government divisions, if necessary, and will be supported by Loan Implementation Environmental Consultant (LIEC).

ii). The EPBs hotline and email address will form part of the GRM.

iii). Prior to construction, key contact points for the GRM will be identified. These will include: the project IAs, contractor foremen (or contractor-nominated environmental and safety personnel), EPB, and residential committee heads. These personnel will be informed of the GRM and will ensure that their respective staff are aware of their responsibility to receive and forward any complaints

received. Contact details (phone numbers, addresses, e-mail) will be publicly disseminated on information boards at construction sites and on EPB website.

iv). Each contractor will assign an environment, health and safety officer (EHSO).

v). A series of clear steps to identify how any complaints are received, forwarded to the appropriate persons, addressed within stated timelines, and documented.

175. **Types of grievances which may be received.** Public grievances addressed by the GRM will most likely relate to environmental issues during the construction phase, as consultations with communities confirmed basic support for the project. Grievances may include: (i) damage to public roads due to water supply pipeline laying, and heavy vehicle operation and transportation of heavy equipment and materials; (ii) disturbance of traffic and increased traffic congestion; (iii) dust emissions; (iv) construction noise and vibration; (v) soil erosion; (vi) inappropriate disposal of construction spoils; (vii) loss of income; (viii) damage to private homes; (ix) safety measures for the protection of the general public and construction workers; and (x) reservoir water quality deterioration during water source pumping station constructions.

176. **GRM procedure.** The GRM procedure is as follows (**Figure IX.1**). Any and all costs associated with addressing and solving public grievances shall be covered by the project. The GRM will remain open until the completion of project construction. Under the GRM, three entry points have been established – i.e. agencies which any affected person may contact: LUCRPO, the IAs, the construction contractors, and the construction supervision companies. The procedure of the mechanism is as follow:

(i) **Stage 1.** The AP submits a written or oral complaint to any of the established entry points for the project GRM. The GRM agency which receives the complaint will immediately report it to the LUCRPO and IAs' Environment and/or Social Officer, who will prepare a written record of the complaint. LUCRPO or the IAs Environment and/or Social Officer will immediately facilitate a meeting among the GRM agencies to (i) identify a course of action, (ii) inform the other GRM agencies if necessary, (iii) emphasize discretion and respect for the AP, and anonymity if this is requested by the AP and/or LUCRPO and the IAs decides this will benefit the AP, and (iv) identify which GRM agency will lead resolution of the issue with the AP. Initiating resolution with the AP will occur within 7 days of the complaint being received by the GRM entry approached by the AP. As far as possible the issue will also be resolved within this 7-day period, to the satisfaction of the AP and PMO. The LUCRPO and IAs' Environment and/or Social Officer will closely oversee this process and ensure a written record is kept of the process. Complaints which are clearly not project-related and/or are outside the mandate of the GRM (e.g. resettlement, fraud, corruption), and for which other procedures are more appropriate, will be passed to relevant authorities. The LIEC will assist LUCRPO and the IAs' officers in replying to the affected person. Records of complaints will be included in the semi-annual environmental reports to the World Bank.

(ii) **Stage 2.** If no solution can be identified by LUCRPO and the IAs' Environment and/or Social Officer and AP, or the AP is not satisfied with the proposed solution, LUCRPO and the IAs will organize, within two weeks, a multi-stakeholder meeting with the AP, contractor, IA, and EPB. The hearing shall identify a solution acceptable to all, and formulate an action plan. The contractors during construction and the IAs during operation will implement the agreed-upon redress solution and report the outcome to LUCRPO and the IAs'

within the agreed upon timeframe.

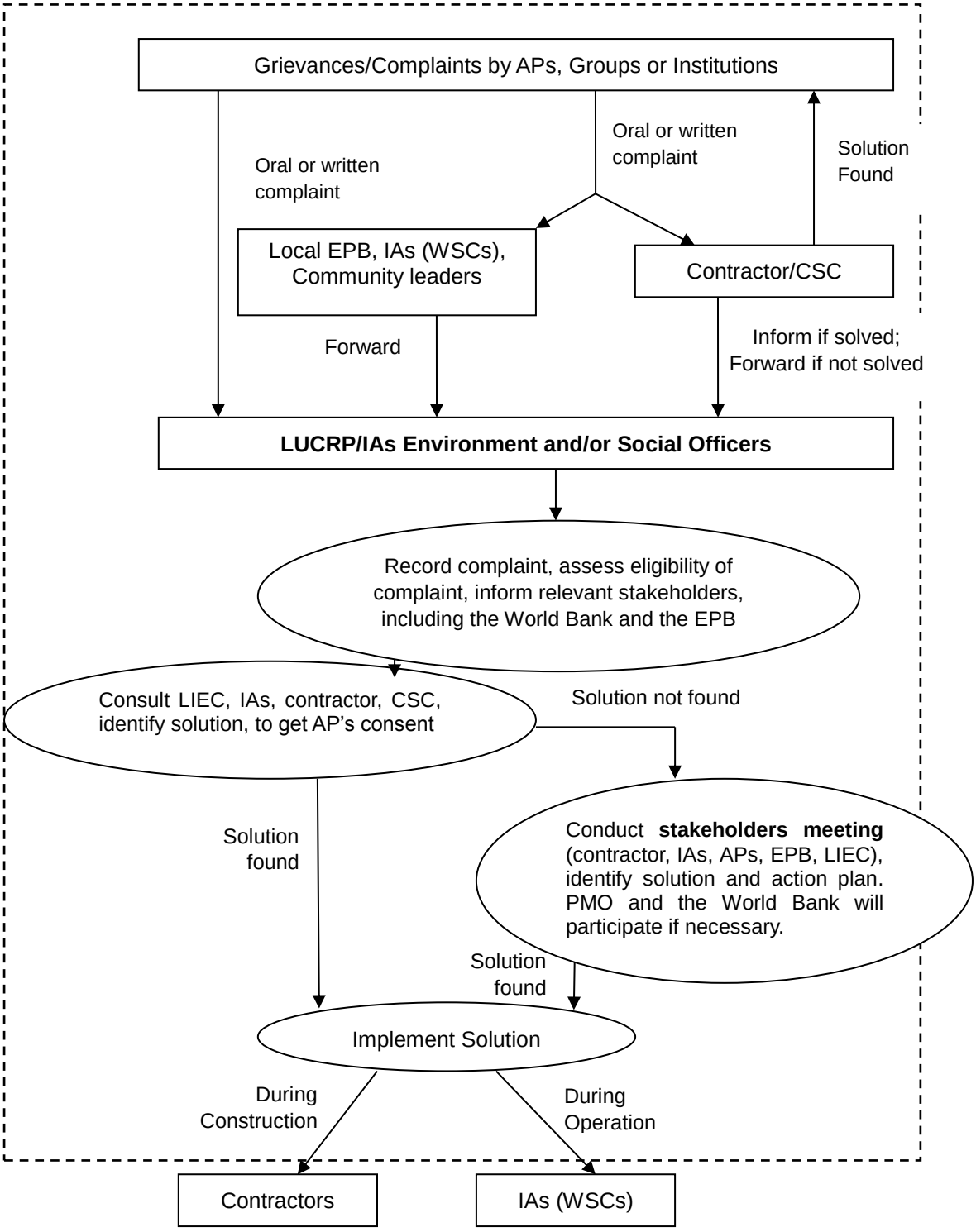


Figure IX.1. The Project GRM.

X. Information Disclosure, Public Consultation and Participation

177. Meaningful public and stakeholder participation and consultation during project planning, feasibility study, design and implementation are an important EA requirement, and can directly reflect the public's perceptions on environmental quality in the project's area of influence.

178. Relevant provisions in the Environmental Protection Law of the PRC and the Regulations on the Administration of Construction Project Environmental Protection (Order of the State Council, No. 253) require that an EA report prepared by a certified EA Institute shall be in accordance with relevant laws to solicit the opinions of organizations concerned and residents within and nearby the project sites. In August 2012, the PRC National Development and Reform Commission (NDRC) issued a new requirement for "Social Risk Assessment of Large Investment Projects", which emphasizes the importance of public consultations in an effective manner, and requires that the results of public consultation are clearly summarized in the EA report, including the dates of consultations, number of stakeholders, who the stakeholders are, and the comments received. It is also important to show how the concerns and comments from the stakeholders and affected persons (APs) have been addressed by the updated FSR, the project design, the EA and EMP. The World Bank Safeguard Policy (OP/BP4.01) also requires meaningful public participation, consultation and information disclosure. The information disclosure in this Project is website and local newspaper. Forums and questionnaire will be used for public consultation.

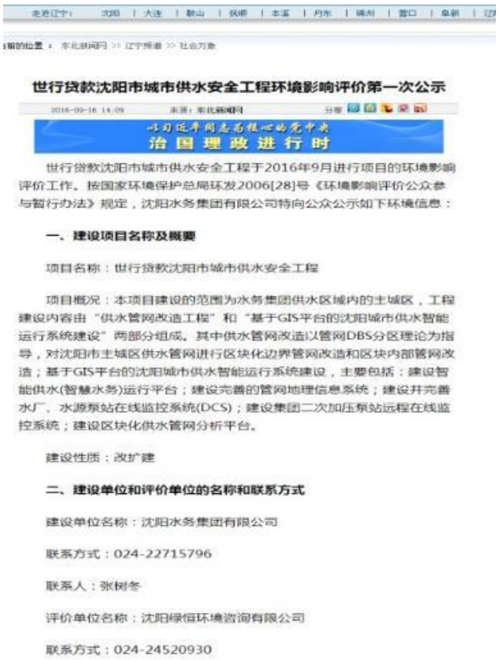
X-1 Information disclosure and public consultation

179. The information disclosure for the city subprojects were conducted by the EIA Institutes in the five project cities, which include: i)project name, IAs, management units and funding source; ii)project content and planned construction methods (brief introduction); iii) estimated construction period (starting and completing time); iv) project scope and estimated environmental impact type and scope; v) mitigation measures and monitoring plan in EA and EMP; vi) EA and EMP; and vii) project IAs (5 water supply companies), contact details of the LUCRPO, IAs, the EA Institutes and local EPBs.

180. The information disclosure was posted on the website of Liaoning Provincial Housing and construction division on 28 February 2017 (http://www.lnjst.gov.cn/website/main/index.aspx), the information posted include the project cities, the contents of project and subprojects, and the link of EMP. The information disclosure time and media is shown in Table X-1. The screenshots for information disclosure are in Figure X-1-Figure 6.

Table X-1 the Public Information Disclosure

City	Date	Media Posted
Shenyang	10 Oct. 2016	The website of northeast news (ww.nen.com.cn)
Anshan	17 Oct. 2016	Anshan Daily Newspaper
Fushun	16 Dec. 2016	The website of Fushun Water Company
Fuxin	3 Jan. 2017	The website of Fuxin Municipal EPB
Gaizhou	26 Sep. 2016	The website of Gaizhou Municipal Government
Liaoning (EMP,	28 Feb. 2017	The website of Liaoning Provincial Housing



世行贷款沈阳市城市供水安全工程环境影响评价第一次公示

以习近平同志为核心的党中央 治国理政进行时

世行贷款沈阳市城市供水安全工程于2016年9月进行项目的环境影响评价工作。按国家环境保护总局环发2006[28]号《环境影响评价公众参与暂行办法》规定，沈阳水务集团有限公司特向公众公示如下环境信息：

一、建设项目名称及概要

项目名称：世行贷款沈阳市城市供水安全工程

项目概况：本项目建设的范围为水务集团供水区域内的主城区，工程建设内容由“供水管网改造工程”和“基于GIS平台的沈阳城市供水智能运行系统建设”两部分组成。其中供水管网改造以管网DBS分区理论为指导，对沈阳市主城区供水管网进行区块化边界管网改造和区块内部管网改造；基于GIS平台的沈阳城市供水智能运行系统建设，主要包括：建设智能供水(智慧水务)运行平台；建设完善的管网地理信息系统；建设井完善水厂、水源泵站在线监控系统(DCS)；建设集团二次加压泵站远程在线监控系统；建设区块化供水管网分析平台。

建设性质：改扩建

二、建设单位和评价单位的名称和联系方式

建设单位名称：沈阳水务集团有限公司

联系方式：024-22715796

联系人：张树冬

评价单位名称：沈阳绿恒环境咨询有限公司

联系方式：024-24520930

Figure X-1 First Information Disclosure (Shenyang)

鞍山日报

2016 17

鞍山市自来水总公司

鞍山市城市供水系统提标改造工程公众参与信息公告

鞍山市自来水总公司《鞍山市城市供水系统提标改造工程》项目的环境影响评价工作已基本完成，根据《环境影响评价公众参与暂行办法》(环发[2006]28号)的相关规定，现对该项目环境影响评价的主要内容、评价结论等进行公告，以便征求相关部门和广大公众的意见和建议，公示内容如下：

一、建设项目情况简述

鞍山市城市供水系统提标改造工程建设地点位于鞍山市、辽阳市弓长岭区，主要工程包括汤河水源泵站改造及王家峪净水厂提标改造工程、智慧水务建设工程、阀门及老旧管网改造工程、二次供水泵站改造及庭院管网工程、弃管楼楼内管道及庭院管网改造工程。

二、建设项目对环境可能造成的影响及预防或者减轻不良影响的措施

施工期：①废气：主要为施工扬尘、汽车尾气、焊接焊烟、防青烟。对施工场地定期洒水抑尘，设置标准围挡，采用密闭车斗运输物料，边施工边回填减少开挖面等措施减少扬尘；加强设备维护，合理安排运输车辆等措施控制汽车尾气；对于产生的防青烟，采用外购成品商业防青，施工前先告知居民。②废水：主要为施工废水及施工人员产生的生活污水，含泥浆废水经沉淀处理后上清液同生活污水用于场地附近洒水抑尘。另管道试压废水属于清净污水，试压工作完成后，试压用水用于洒水抑尘或附近道路两侧绿化。③噪声：噪声源主要是设备噪声，采取限制施工时间(22时～次日6时严禁施工)、避免产生噪声大的设备同时开启、选用较先进、噪声较小的施工设备等措施；另外运输车辆经过附近居民住宅等时要慢行减速，禁止车辆鸣笛。④固废：施工过程产生的建筑垃圾办理排放许可证并排放到指定地点，少量生活垃圾集中收集后由环卫部门送至垃圾填埋厂填埋处理，拆除淘汰下来的废旧设备外售处理，大孤山泵站出水段管线产生废泥浆自然干化后由相关部门或单位外运处理。

营运期：①噪声：噪声源主要是改造后王家峪净水厂和二次加压供水泵站内的鼓风机、水泵、电机等设备运行时产生的噪声，采取选用低噪设备降低源强，各类水泵建立独立设备基础，不得与主体基础连接，水泵出口采用软连接等减振，隔声措施。

三、环境影响评价结论的要点

项目符合国家的产业政策，污染防治措施完善可行并可实现稳定达标排放，在采取了设计及本环评要求采取的污染防治措施后，项目的实施对周围环境影响较小，从环境保护角度看，本项目的实施是可行的。

四、环境影响报告表的查阅方式

报告表简本见辽宁瑞尔工程咨询有限公司网站，网址为http://www.lnregczx.com/。

五、征求公众意见的范围和注意事项

范围：受建设项目直接影响或间接影响的单位和个人以及关注项目建设的单位和个人。注意事项：意见包括对工程建设的意见；对本报告提出的环保对策与减缓影响措施的意见；对项目环境影响报告表(简本)的意见；对项目环境保护的建议、要求；对本报告综合评价结论的意见。

六、起止时间和联系方式

请您在公告发布后10日内，将您的意见或建议通过来信、来访、发邮件等方式反映给环评单位或建设单位。

1、建设单位：鞍山市自来水总公司

联系人：王主任 15042242601

E-mail:17890401@qq.com

2、环评单位：辽宁瑞尔工程咨询有限公司

联系人：赵女士 0412-6313078

E-mail: liaoningruier@163.com

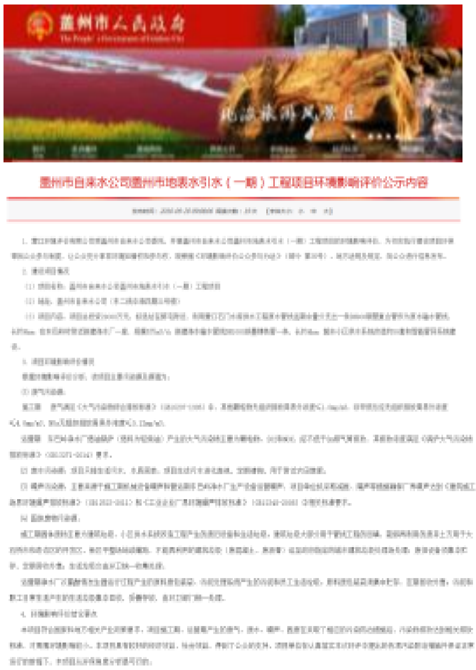
Figure X-2 First Information Disclosure (Anshan)

抚顺市自来水公司

FUSHUNSHI ZILAISHUI GONGSI

抚顺市世行贷款供水改造工程项目环境管理计划信息公示

Figure X-3 First Information Disclosure (Fuxin)



盖州市人民政府

盖州市自来水公司盖州市地表水引水（一期）工程项目环境影响评价公示内容

Figure X-4 First Information Disclosure (Gaizhou)

Figure X-5 Information Disclosure (Fuxin)

Figure X-6 The project EMP disclosure on Liaoning HCD Website

181. **Future information disclosure.** During construction and operation of the project, public consultation and participation plan is an important part of EMP. The future information disclosure will include: i) questionnaire, home survey, forum and consultation meeting; ii) affected person and stakeholder's participation in EMP inspection and monitoring; iii) public consultation after project completion. These consultation will help to collect public attitude and opinion of project performance.

X-2 Public participation and consultation

182. The public consultation was conduction in forum and questionnaire. The investigators are analyzed by gender, age, occupation information in **Table X-2**. The public opinion result is shown in **Table X-3**. Shenyang project also conducted social group consultation, the result is shown in **Table X-4**.

Table X-2 Respondents of 1st Round of Questionnaire Survey

Information of Consulted APs		Shenyang		Anshan		Fushun		Fuxin		Gaizhou	
		21-27 Dec. 2016		17-18 Nov. 2016		26-30 Dec. 2016		26-30 Dec. 2016		27-28 Dec. 2016	
		No. of Resp.(85 in total)	(%)	No. of Resp. (50 in total)	(%)	No. of Resp. (50 in total)	(%)	No. of Resp. (60 in total)	(%)	No. of Resp. (30 in total)	(%)
Gender Distribution	Male	27	31.76	27	54	24	48	25	41.7	20	66.7
	Female	58	68.24	23	46	26	52	35	58.3	10	33.3
Age Group	<20	0	0	0	0	0	0	2	3.3	0	0
	20-40	21	24.71	25	50	26	52	32	53.3	7	23.3
	41-59	36	42.35	25	50	19	38	19	31.7	17	56.7
	≥60	28	23.94	0	0	5	10	7	11.7	6	20
Education	Below junior high school	7	8	0	0	1	2	6	10	6	20
	High school	39	46	1	2	14	28	36	60	14	46.7
	College and above	39	46	49	98	33	66	18	30	10	33.3
	Not filled	0	0	0	0	2	4	0	0	0	0
Occupation	Worker	16	18.8	21	42	26	52	27	45	11	36.8
	Peasants	0	0	0	0	2	4	3	5	10	33.3
	Cadre	6	7.0	29	58	12	24	16	26.7	0	0
	Immigrant Staff	10	11.8	0	0	3	6	5	8.3	1	3.3
	Retirees	8	9.4	0	0	5	10	9	15	1	3.3
	Not filled	28	32.9	0	0	2	4	0	0	7	23.3

Source: the DEIAs

Table X-1: Results of 1st Round of Questionnaire Survey

Question	Option	Shenyang		Anshan		Fushun		Fuxin		Gaizhou	
		21-27 Dec. 2016		17-18 Nov. 2016		26-30 Dec. 2016		26-30 Dec. 2016		27-28 Dec. 2016	
		Person/85	%	Person/50	%	Person/50	%	Person/60	%	Person/30	%
What do you think of this project, is it good for you?	Good	84	98.8%	50	100.0%	50	100.0%	58	96.7%	30	100.0%
	Bad	1	1.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Not sure	0	0.0%	0	0.0%	0	0.0%	2	3.3%	0	0.0%
What impact of this project do you think will affect your life	No impact	29	34.1%	0	0.0%	11	22.0%	2	3.3%	0	0.0%
	Traffic	43	50.6%	22	44.0%	14	28.0%	21	35.0%	14	46.7%
	Noise	12	14.1%	26	52.0%	19	38.0%	14	23.3%	8	26.7%
	Living	19	22.4%	0	0.0%	2	4.0%	16	26.7%	0	0.0%
	dust	9	10.6%	2	4.0%	4	8.0%	7	11.7%	8	26.7%
Do you understand the meaning of this project?	Yes	84	98.8%	50	100.0%	42	84.0%	57	95.0%	30	100.0%
	No	1	1.2%	0	0.0%	8	16.0%	3	5.0%	0	0.0%
Do you have concerns on road excavation nearby?	Yes	40	47.1%	32	64.0%	28	56.0%	56	93.3%	30	100.0%
	No	45	52.9%	18	36.0%	22	44.0%	4	6.7%	0	0.0%
Have you ever complained to relevant departments or had dispute with others on water issues?	Yes[6]	9	10.6%	2	4.0%	5	10.0%	2	3.3%	0	0.0%
	No	76	89.4%	48	96.0%	45	90.0%	58	96.7%	30	100.0%
If in the water supply project affect	Report to	35	41.2%	28	56.0%	21	42.0%	32	53.3%	22	73.3%

[6]Reason：underground pipes are aging

your work and life, whom will you report to?	contractor										
	Report to WSC	49	57.6%	2	4.0%	4	8.0%	5	8.3%	2	6.7%
	Report to EPB	12	14.1%	20	40.0%	25	50.0%	23	38.3%	6	20.0%
How long road excavation nearby takes is the most appropriate?	One week	31	36.5%	10	20.0%	8	16.0%	0	0.0%	0	0.0%
	Half a month	27	31.8%	12	24.0%	10	20.0%	12	20.0%	5	16.7%
	One month	19	22.4%	10	20.0%	16	32.0%	21	35.0%	14	46.7%
	Three months	4	4.7%	15	30.0%	9	18.0%	25	41.7%	7	23.3%
	half a year	0	0.0%	3	6.0%	7	14.0%	2	3.3%	3	10.0%
	Doesn’t matter	4	4.7%	0	0.0%	0	0.0%	0	0.0%	1	3.3%
In consideration of economic, social and environmental benefits of this project, do you support this project?	Support	80	94.1%	50	100.0%	49	98.0%	58	96.7%	30	100.0%
	Not support	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Doesn’t matter	5	5.9%	0	0.0%	1	2.0%	2	3.3%	0	0.0%
Do you have any comments or suggestions on the implementation of this project?	See paragraphs below.										

Source: the domestic EIAs

183. During the public consultation in five cities, 275 public questionnaires were issued and received 275 copies, women accounted for 55.3% (five cities comprehensive statistics, same below); for the age composition, age between 20 to 40 years old accounts for 40.4%, between 41 to 59 accounts for 42.2%, above 60 years old accounts for 16.7%. For the education level, people's highest education is elementary school and did not fill accounts for 8% of the total number of surveyed, middle school and high school accounts for 37.8%, college or above accounted accounts for 54.2%. For the occupation, workers accounts for 36.7%, white-collar cadres/teacher/doctor accounts for 22.9%, farmers accounts for 5.4%, retiree is occupied of 8.4%, floating population accounts for 6.9%, ones did not fill accounts for 1.3%.

184. The comprehensive statistics of five cities public participation questionnaire indicates that, in the investigation:

i). 98.9% of the respondents think that the implementation of this project is good since this project will improve the city tap water coverage, solve the problem that the edge parts of the city's lower water supply pressure problem, improve urban tap water quality, provides the public health, reduce the leakage rate (reducing pipe repair impact on the residents and traffic), and save water resources.

ii). 41.4% of the investigators said that engineering construction, especially the urban pipeline construction, will affect the traffic, 28.7% of people think that noise is the major impact during the construction; at the same time, 10.9% of the investigators think that construction dust is the main impact. 15.3% of the total said construction has no impact at all. The data indicates that the public concerned about mostly is the impact of the project construction to transportation, followed by dust and noise. In addition, there are some investigators think that the construction may cause stopping of water supply, which may affect their daily life.

iii). 95.6% of the public understand meaning of construction project; 67.6% of the total has concerns on pipe construction nearby. It suggests that though the public dislike the construction activities, the vast majority of the public understands the advantages after then.

iv). In response to the nuisance phenomenon arising during construction, 50.2% of the public choose to report to the contractor, 22.5% chose to report to the water company, 31.3% chose to complain to the local environmental protection bureau and supervision organization. It indicates that in the process of construction, contact and complaint information of contractor, the owner and the regulators should be released in the eye-catching place to provide the public of convenience to complaint and claim;

v). In the selection of construction duration, 17.8% of the total chose a week, 24.0% of people chose the half a month, 29.1% chose a month, 21.8% chose 3 months, 5.4% of people choose for half a year, another 1.8% said doesn't matter. Investigators who choose within three months accounts for 92.7%. It suggests that the majority of the public want to shorten the construction duration as far as possible.

vi). 97.1% of the public expressed support for the project, another 2.9% said doesn't matter. It indicates that the project is supported by the majority of the public.

185. The opinions of the other investigators include: i) hope to project completed as soon as possible, shorten the construction duration; ii) hope that through the construction of this project, water quality of water supply would get great improvement; iii) want to decrease frequency and duration the water supply cutting off, time, especially in the summer, to reduce the impact on residents' life; iv) hope to strengthen the engineering quality, prolong the service life of pipelines and reduce the repeated excavation construction.

186. At the forums, some residents also question the cost of water supply reconstruction in residential area, as well as the water source and water quality. In addition, they also asked about problems such as tap water price. For residents' concerns, EIA units and water company representatives provided answers. As for water supply safety, water company representatives made explanation from aspects as tap water production, water quality monitoring, water transportation and distribution, secondary pump station.

187. After public participation, five EIA units reported public opinions to water companies and design institute (FSR unit), corresponding environmental impact mitigation measures are added in the revision of the FSR and the EIA report, including: 1) length of pipeline construction excavation each time not more than 300 m, take sections to construct, block road to recovery to shorten the construction period, reduce the impact;2) using site sprinkler, transport vehicles covering, the site temporary storage covering of earthmoving and construction materials to control construction dust;3) set up the site temporary wall, control the construction time (8:00-18:00) to reduce noise;4) during pipeline construction, use water supply dispatching management and the valve control to reduce the frequency and duration of water supply cutting off, and send notice to the residential area 48 hours before the construction.

188. Shenyang project scale is wide and involves a large population, it covers the whole urban area. Shenyang EIA units conducted 8 social investigations, 8 copies of answers are received, including religious institutions Nanguan Catholic Church in Shenyang, Shenyang Chemical Industry Research Institute, and five commercial institutions. According to the nature of the project, business consulting surveys conducted mainly choose the food service industry, the conclusion is as follows:

i). two individual businesses objected to this project construction, which accounts for 25% of the total number of surveyed, the main reason is that they worry about water supply cutting off will affect its business;

ii). Shenyang Nanguan Catholic Church expressed that they understand the objective and necessity of the project, they hope that the project construction period to avoid the Catholic Easter and large religious festivals to prohibit traffic congestion nearby;

iii). 75% of investigated institutions showed support to this project.

189. For the appeal, water company representative said they would try to ensure the water supply to commercial businesses along the street during the day, in order to

reduce the impact on businesses. It is determined the date of the construction to avoid the Catholic Easter, the Holy Spirit as well as the Virgin Ascensiontide religious holiday (April 1, May 22 and August 15). EIA units have reported the information Shenyang Water Company and Design Institute, the construction of the pipeline will be conduct during September to October of 2018 to reduce the influence of the Catholic Church.

X-3 Additional information disclosure and public consultation for Gaizhou adjusted project

190. After the World Bank project pre-appraisal in November 2016, Gaizhou project was adjusted due to the water source issue of Shimen Reservoir. The subproject was changed from original construction of 50,000 m^3/d WSP, with the raw water from the reservoir to directly purchasing clean water from the existing Yingkou Guotun WSP, So that about 1km changed water transmission pipeline will pass the villages of Jiajia and Gujiazi, therefor the addition public consultation needed to be conducted.

191. **The information disclosure.** The information for the project adjustment was posted on the website of Gaizhou municipal government on 3rd May 2017 (http://www.gaizhou.gov.cn/newsinfo.php?id=7324), the information posted include the contents of project, proposed environmental impacts mitigation measures, as well as the methods and ways of the public consultation. The screenshots for information disclosure is shown in Figure X-7.

192. **The public consultation.** The EIA Institute, with the assistance of Gaizhou WSC, conducted the public consultation on 5 and 6 May 2017 within the increased project impact scope of Jiajia, Gujiazi and Donngbaling villages. Fifty questionnaires were distributed to fifty (50) APs from different age groups, gender and occupations (Table X-3), and 100% questionnaires were completed and returned. The result showed 100% respondents expressed they had known the benefits and necessity of the project, and showed their support to the project.

Table X-3 Respondents of additional questionnaire survey for Gaizhou adjusted project

Information of Consulted APs		Gaizhou	
		5-6 May 2017	
		No. of Resp.(50 in total)	(%)
Gender Distribution	Male	39	78
	Female	11	22
Age Group	<20	0	0
	20-40	6	12
	41-59	35	70
	≥60	9	18
Education	Below junior high school	27	54
	High school	16	32
	College and above	7	14
	Not filled	0	0
Occupation	Worker	10	20

	Peasants	37	74
	Cadre	0	0
	Immigrant Staff	0	0
	Retirees	1	2
	Not filled	2	4

盖州市自来水公司盖州市地表水引水（一期）工程项目环境影响评价公示内容

发布时间：2017-05-03 14:38:37 阅读次数：1次 【字体大小：小 中 大】

1. 营口环境评价有限公司受盖州市自来水公司委托，开展盖州市自来水公司盖州市地表水引水（一期）工程项目的环境影响评价，为切实执行建设项目环保审批公众参与制度，让公众充分享有环境知情权和参与权，现根据《环境影响评价公众参与办法》（部令 第35号）、地方法规及规定，向公众进行信息发布。

2. 建设项目情况

（1）项目名称：盖州市自来水公司盖州市地表水引水（一期）工程项目

（2）地址：盖州市自来水公司（东二线中海四期21号楼）

（3） 项目内容：项目利用营口石门水库供水工程处理后的净水重力送至城区配水管网，新建一条DN1000球墨铸铁管净水输水管线，长约 12km；并对现有塔山水厂和河南水厂进行改造；小区二次管网改造总长度为236km，管径为de50～de315；楼内管改造总长度74km，管径为de25～de63mm；改造 14 座小区二次加压泵站；更换智能水表 32050 户；新建一套智能管网系统。

3. 项目环境影响评价情况

根据环境影响评价分析，该项目主要污染源及源强为：

⑴ 废气污染源：

施工期废气满足《大气污染物综合排放标准》（GB16297-1996）中，其他颗粒物无组织排放周界外浓度≤1.0mg/m3，非甲烷总烃无组织排放周界外浓度≤4.0mg/m3，NOx无组织排放周界外浓度≤0.12mg/m3。

运营期无废气产生。

⑵ 废水污染源：项目只排生活污水，水质简单。项目生活污水进化粪池，定期清掏，用于附近农田堆肥。

⑶ 噪声污染源：主要来源于施工期机械设备噪声和营运期供水水泵等设备运营噪声，项目单位拟采取减振、隔声等措施确保厂界噪声达到《建筑施工场界环境噪声排放标准》（GB12523-2011）和《工业企业厂界环境噪声排放标准》（GB12348-2008）中相关标准要求。

Figure X-7 Information Disclosure (Gaizhou adjusted project)

193. **The main opinion of respondents:** the respondents reflected that they are currently drinking groundwater from local deep wells without any environment protection and monitoring devices, they hope change to treated water after the project completion; another concern the respondents expressed is compensation fee for the temporary land occupation during the pipeline construction.

194. For the above issues, the representatives of Gaizhou WSC expressed that i) they will proactively try to solve the problem for the villages connecting with the Gaizhou municipal water supply system; ii) promised to compensate the villages in accordance with the PRC policies and local standard for the temporary land occupation. After the public consultation, all the participants expressed understand and accept the public consultation.

Figure X-8 Questionaries' survey in Shenyang Dadong District

Figure X-9 Questionaries' survey in Shenyang Shenhe District

Figure X-10 Public Hearing Meeting in Fuxin Xinqiu District

FigureIX-11 Public Hearing Meeting in Fuxin Xinqiu District

Figure X-12 Public Hearing Meeting in Gaizhou

Figure X-13 Public Hearing Meeting in Gaizhou

XI. Appendix 1 Water Supply Project Environmental Implementation Practices during Construction

1. The implementation practice is formulated in order to protect the ecological environment near the construction site, construction personnel's health and life security, improve the work environment for construction workers, prevent water loss and soil erosion during construction, and the avoid pollution to the environment and all kinds of diseases.

2. This chapter puts forward the environmental protection measures that shall be taken by the contractor during construction, it mainly include the environmental management of construction site, dust pollution and harmful gas emissions control, water pollution control of municipal solid waste, noise control, solid waste control, soil erosion and water loss control and etc..

i). In the contractor's construction organization design, there should be the effective measures to prevent pollution to the atmosphere, water, noise, solid waste, and the to avoid water loss and soil erosion and improve environmental sanitation.

ii). In the process of construction, the environmental protection measures should be carried out in construction organization design to protect the air, surface water, sound environment and ecological environment quality, satisfy the requirement of functional zones, and accept the supervision from the environment supervision and management institutions.

iii). The construction site must establish environmental protection, environmental sanitation management and inspection system, and should keep inspection record.

iv). The contractor should take effective occupational disease prevention measures, provide necessary protective equipment to workers, physical examination and training should be provided to personnel engaged in the occupational-disease-inductive work on a regular basis (at least once a year).

v). The construction works should be combined with seasonal characteristics, the contractor should make good organization on workers' diet health cooling and warm, and take effective measures to prevent gas poisoning, epidemic prevention, etc.

vi). Trainings and assessment of construction personnel should include laws and regulations on environmental protection, environmental sanitation.

vii). According to laws and regulations, the contractor should formulate the public health emergency contingency plans in construction site.

3. **Construction site layout and temporary facilities.** The scope of construction site include construction area, office area and construction staff

living zones.

i). The construction area should be divided from office and living area, corresponding isolation measures should be taken to ensure that cleaning and order in entire construction area.

ii). The construction area and living area shall be equipped with corresponding environmental protection facilities or the environmental impact reduction measures, such as dust, noise control measures in construction area and etc.

iii). The construction site entrances should be marked with the contractor and supervision company name or logo. In the obvious places, project information board shall be set up, and institutional board should also be set up include information on safety production, fire control, environmental protection and civilized construction.

iv). If the construction needs to interrupt municipal services (including water, electricity, telephone, Internet and public transit, etc.), notices should be posted at least five days earlier to inform the affected residents and enterprises, and indicate the beginning and ending time of service interruption.

v). It is strictly prohibited to set dormitory within unfinished buildings.

vi). Temporary facilities shall all be removed within month of construction project completion.

4. **Operation condition and environmental safety**

i). The construction site must adopt closed color-steel fence with height not less than 2.5 m, 3 m in sensitive area.

ii). The construction site should set up the bulletin board to show site layout and safety production, fire control, environmental protection and civilized construction system, as well as the public emergency treatment chart.

iii). The construction unit should take protective measures to ensure the safety of adjacent buildings, structures and construction project safety and underground pipeline safety.

iv). During construction, hard security protection measures should be taken to the peripheral pedestrian street, entrance/exit, while lighting indicating devices shall be set up at night.

v). Eye-catching safety warning marks shall be set up near the construction site entrances and exits, the construction hoisting machinery, temporary electricity facilities, scaffolding and access

gangway and other dangerous parts. Safety warning signs must be in line with national standards.

vi). In different stages of construction and when season, climate and environment changes, corresponding safety technical measures should be taken to the construction site to achieve safe civilization construction conditions.

vii). The firefighting equipment should be properly maintain, piled up obstacles will not be set to escape way.

5. **Pollution control implementation procedures**.

6. **Dust control**: The main sources of dust include road traffic, construction site, building materials, earthwork stack, earthwork, waste residue, construction waste , transportation process, the original road demolition, concrete and mortar mixing works. According to the dust pollution source, this procedure put forward the following dust pollution control measures:

i). The bare ground in construction site should use sprinkler to suppress dust.

ii). Materials should be piled up tightly within the construction site and reduce material surface area.

iii). The materials that are easy to float in the sky or with fine particles should be sealed storage, handling shade measures should be taken during loading and unloading.

iv). The earth should be gathered stacking, concentrated pile up of earth should be covered, curing and other measures. Excavated soil with pile location should be calculated balance ahead of construction, or take earthwork resource allocation between adjacent construction site to make the most of the original soil backfill, maintain a balance between excavation and fill earthwork quantity.

v). Transportation of earthwork and construction waste residue must use closed transportation vehicles.

vi). If the construction will use ready-mixed concrete and ready-mixed mortar, the construction site shall not set mixing plant.

vii). The commercial concrete and mortar should be bought from qualified concrete enterprise with environmental protection facilities.

viii). When it is windy weather with more than Grade Four, earthwork backfilling, transshipment and other construction activities producing dust pollution should not be taken undertaken.

7. **Harmful gas emissions control**: During project construction, the harmful gas is mainly from construction machinery and transport vehicle emissions, in order to control gas pollution, the procedures proposed emission control measures are as follows:

i). The construction site shall strictly prohibited incinerate all kinds of waste.

ii). The construction vehicles, machinery and equipment should be regularly maintained to keep good condition, the gas discharged should comply with national exhaust emission standards.

8. **Water pollution control**: During construction, waste water mainly generates from construction wastewater, workers' domestic sewage, and water pollution caused by crossing the river, of which, the construction waste water generates from the hydrostatic test and disinfection washing, etc. Aiming at the above-mentioned waste water, the proposed emission control measures include:

i). For scattered project construction sites, domestic sewage should existing public health facilities, after preprocessing, it should be discharged into the municipal sewage pipe network. It is prohibitive to discharge domestic sewage in scattered places.

ii). For wastewater generated in water pressure test and washing disinfection, although it is clean water, the direct emission to trenches also can cause certain pollution of soil, the EIA requires discharge it to municipal sewage pipe network nearby. Due to specific project construction time and places, all the pipe sections are scattered, this kind of wastewater will be discharged at different position into the urban sewage pipe network for many times, it will not challenge wastewater treatment plant.

iii). The crossing way will adopt drawn tube and pipe jacking construction methods to reduce pollutants during construction, especially the suspension effect on the river.

9. **Noise control**: Construction noise pollution mainly generated by the construction machinery and transport vehicles, the impact is around the construction site and both sides of roadways. According to the characteristics of noise pollution in small construction project, the proposed emission control measures are listed as follows:

i). The reasonable arrangement of construction plan: it is essential to formulate scientific construction plan to avoid using large number of high noise equipment at the same time. In addition, the construction equipment with large noise, strong impact and vibration should be scheduled during the daytime, and should be prohibited during night (22:00 to 6:00 the next day).

ii). Reasonable construction site layout: it should make reasonable

arrangement of construction plan and method. Scattered machinery equipment arrangement is an appropriate way to avoid too many power equipment settled in the same place resulting in high local sound level.

iii). Equipment sound level reduction 1) Select equipment with low, such as hydraulic machinery instead of fuel oil, vibrorammer instead of high-frequency vibrator, high noise machinery install silencer; conduct maintenance work to mechanical equipment everyday; 2) exhaust muffler can be installed to fixed, digging and earth moving equipment, such as excavator, bulldozer, etc.;3) for equipment that doesn't use, it should be shut down immediately, transport vehicles entering the site should be slow down and avoid horning.

iv). Establish temporary noise barrier: set up temporary silencing plate sound barrier to high noise equipment around acoustic sensitive areas, sound barriers should be higher than the ground by more than 1.2 m, width than machines working area by more than 2 m to guarantee the construction noise emissions is lower than standard.

v). For the transport vehicles entering the construction site, the vehicle speed should be less than 20 km/ hour, it is strictly prohibited to horn.
In addition to the above noise reduction measures, it is important to establish good community relations with companies and residents along. Companies and residents who will be impacted by the construction should be noticed before operation, and inform them of construction measures to reduce noise to get common understanding. To companies and residents that are greatly influenced by the construction, appropriate compensation should be provided. In addition, during construction, hotline telephone should be set up to accept noise nuisance complaints, and make corresponding treatment.

10. **Waste control**: During construction, solid waste can be generated from construction and domestic waste, among them, construction waste is the main source. The main materials include soil, sediment, scattered mortar and concrete, masonry and concrete debris, reinforced concrete pile head, all kinds of packaging materials and other wastes. In view of the project construction, the control measures are listed as following:

i). For domestic waste, fixed-point methods should be adopted to set up special container to collect, and keep cleaning every day on time.

ii). According to different construction time and location, choose the nearest building construction site to transport construction soil to use as filling or greening earth.

iii). Sandstone, building materials, steel products, packaging materials can be recycled and timely cleaned.

11. **Soil and water loss control**: Because this project is all located in the

urban plain areas, as long as strengthening management during construction, soil and water loss can be reduced greatly.

i). The construction site should be pay attention to reasonable piled earth, it is better to set apart with certain distance from the sewers and river, construction materials and digging soil that is not timely discarded should be covered during heavy rain and wind.

ii). The excavation should try to avoid the rainy season. The excavated exposed surface should shorten the exposure time to reduce water and soil loss.

iii). Drainage ditch should be excavated near the construction site to induce ground water in site.

XII. Appendix 2 Emergency Procedures When Cultural Relic Found During Construction

1. No historical relics were found in five cities in the project construction area. But water supply pipeline project include excavation, which should pay attention to the presence of underground cultural relics. Once cultural relics are found, one should immediately notify the local cultural relic's protection department, and protect the scene in a timely manner. The construction can be continued after the cultural relic's department treatment.

2. According to PRC Cultural Relics Protection Law (Oct.28 2002) Article 32, it is regulated that in construction or agricultural production, when cultural relics are found by any unit or individual, one shall protect the scene and immediately report to the local administrative department of cultural relics. After receiving the report, if no special circumstances, cultural relics administrative departments should get to the scene within 24 hours, and put forward handling opinions within seven days. The cultural relics administrative departments may report to the local government to notify the public security department to help protect the scene; when important cultural relics are found, the department shall immediately report to the state council cultural relics administrative department, who shall issue handling opinions within 15 days after the report received. In accordance with the preceding paragraph, cultural relics found shall be owned by the state, no unit or individual shall plunder, privately distribute or hiding.

3. For cultural relics accidentally discovered during construction, the management requirement include:

i). If cultural relics are found during construction, the construction activity should immediately stop, the on-site personnel should protect the scene and not dispose without authorization, and immediately report to the local cultural relics management department.

ii). After opinions are carried out by the cultural relics management department, based on the comments that is issued, the construction unit should develop construction scheme for cultural relics sections, and restart the construction activity after the cultural relics department's consent. Before the end of the archaeological excavations, no unit or individual shall not continue any construction or production activities. No unit or individual shall plunder, privately distribute, or hide the founded cultural relic.

4. The procedure after cultural relics found during construction is shown in the **Figure APP2-1**.

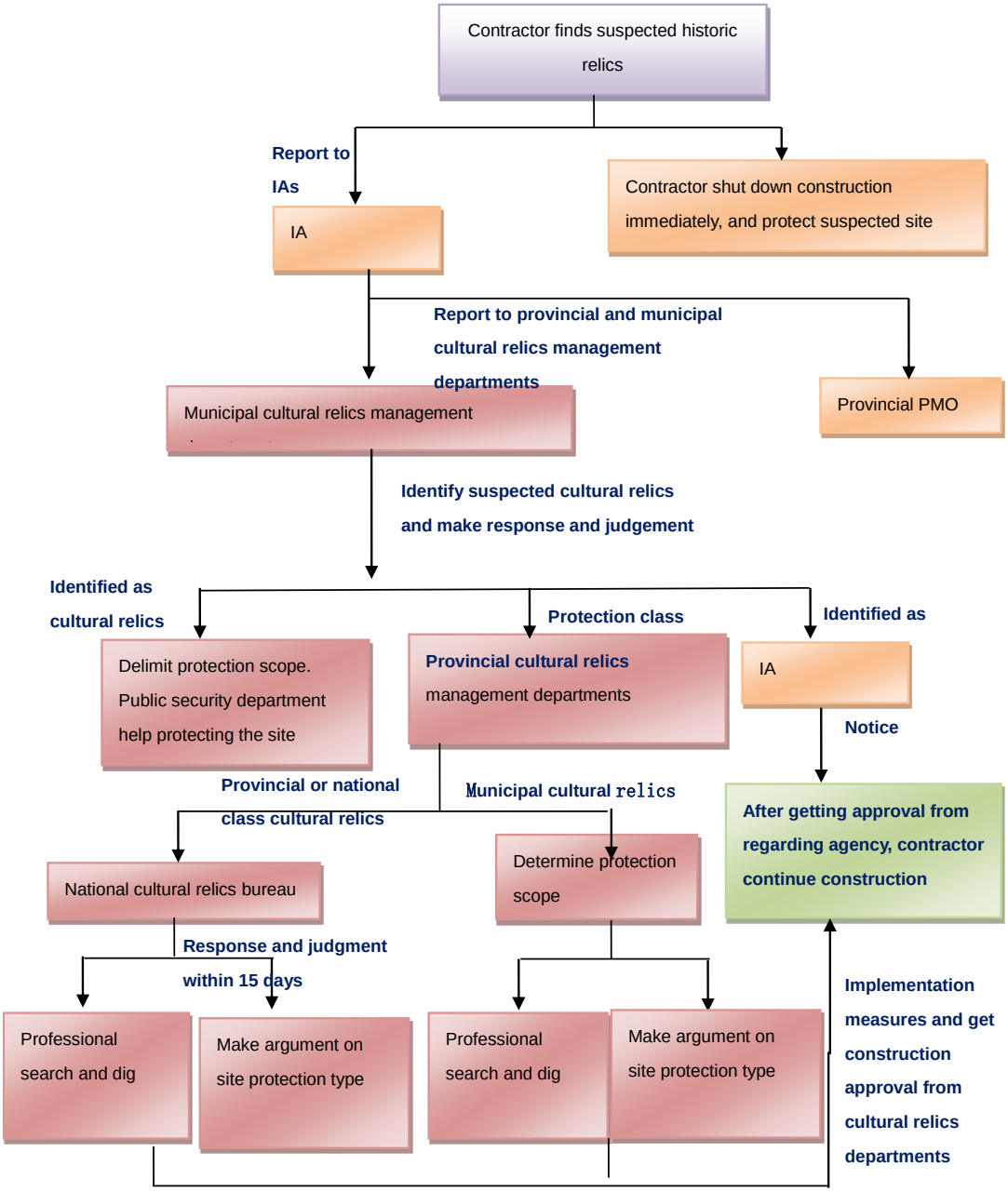


Figure APP-2 Procedure after Underground Cultural Relics Found During Construction