Initial Environmental Examination (Draft)

October 2016

PRC: Guangxi Regional Cooperation and Integration Promotion Investment Program

Prepared by the Government of Guangxi Zhuang Autonomous Region for the Asian Development Bank (ADB).

CURRENCY EQUIVALENTS

(as of 19 October 2016)

Currency unit	–	yuan (CNY)
CNY1.00	=	$0.148
$1.00	=	CNY6.73

ABBREVIATIONS

ADB	-	Asian Development Bank
AP	-	affected person
AQG	-	air quality guideline
As	-	arsenic
AVG	-	average
BEZ	-	border economic zone
BOD_5	-	5-day biochemical oxygen demand
C&D	-	construction and demolition
Cd	-	cadmium
CN	-	cyanide
CNY	-	Chinese yuan
CO	-	carbon monoxide
CO_2	-	carbon dioxide
COD	-	chemical oxygen demand
Cr	-	chromium
Cu	-	copper
DDT	-	dichloro-diphenyl-trichloroethane
DO	-	dissolved oxygen
EA	-	executing agency
EARF	-	environmental assessment and review framework
EEM	-	external environmental monitor
EHS	-	environment, health and safety
EIA	-	environmental impact assessment
EIR	-	environmental impact report
EIRF	-	environmental impact registration form
EIT	-	environmental impact table
EMP	-	environmental management plan
EMR	-	environmental monitoring report
EMS	-	Environmental Monitoring Station
EPB	-	Environmental Protection Bureau
EPD	-	Environmental Protection Department
EPL	-	Environmental Protection Law
ESE	-	environmental supervision engineer
ESMS	-	environmental and social management system
F^-	-	fluoride
FAM	-	facility administration manual
FI	-	financial intermediary
FSR	-	feasibility study report
FYP	-	five-year plan

GDP	-	gross domestic product
GPMO	-	Guangxi Foreign Loans Project Management Office
GHG	-	greenhouse gas
GMS	-	Greater Mekong Subregion
GRM	-	grievance redress mechanism
GZAR	-	Guangxi Zhuang Autonomous Region
Hg	-	mercury
I_{Mn}	-	permanganate index
IA	-	implementation agency
IEE	-	initial environmental examination
IUCN	-	International Union for Conservation of Nature
L_{Aeq}	-	equivalent continuous A-weighted sound pressure level
LAS	-	linear alkylbenzene sulfonate
LDI	-	local design institute
LEED	-	leadership in energy and environmental design
MEP	-	Ministry of Environmental Protection
MSW	-	municipal solid waste
N	-	nitrogen
NH_3-N	-	ammonia nitrogen
Ni	-	nickel
NO_2	-	nitrogen dioxide
NO_X	-	nitrogen oxides
P	-	phosphorus
PAM	-	polyacryl amide
Pb	-	lead
PCR	-	project completion report
pH	-	a measure of acidity and alkalinity
PIU	-	project implementation unit
PM	-	particulate matter
$PM_{2.5}$	-	particulate matter with diameter ≤ 2.5 μm
PM_{10}	-	particulate matter with diameter ≤ 10 μm
PMC	-	project management consultant
PME	-	powered mechanical equipment
PMO	-	project management office
PO_4^{2-}	-	phosphate
PPE	-	personal protective equipment
PPP	-	public-private partnership
PPTA	-	project preparation technical assistance
PRC	-	People's Republic of China
Se	-	selenium
SEA	-	strategic environmental assessment
SME	-	small and medium enterprise
SO_2	-	sulphur dioxide
SPS	-	safeguard policy statement
SS	-	suspended solid
TN	-	total nitrogen
TP	-	total phosphorus
TPH	-	total petroleum hydrocarbon
TSP	-	total suspended particulate
VOC	-	volatile organic carbon

WBG	-	World Bank Group
WHO	-	World Health Organization
WWTP	-	wastewater treatment plant
Zn	-	zinc

WEIGHTS AND MEASURES

^{o}C	-	degree centigrade
dB(A)	-	A-weighted sound pressure level (decibel)
ha	-	hectare
kg/s	-	kilogram per second
km	-	kilometer
km^2	-	square kilometer
L	-	liter
m	-	meter
m^2	-	square meter
m^3	-	cubic meter
m^3/d	-	cubic meter per day
m^3/s	-	cubic meter per second
mg	-	milligram
mg/L	-	Milligram per liter
mg/m^3	-	milligram per cubic meter
min	-	minute
mm	-	millimeter
no./L	-	number of individuals per liter
t	-	metric ton
t/d	-	metric ton per day
µ or µm	-	micron or micrometer
µg	-	microgram
$µg/m^3$	-	microgram per cubic meter

NOTES

In the report, "$" refers to US dollars.

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

A. Background

1. This initial environmental examination (IEE), which includes an environmental management plan (EMP), is prepared for the proposed Guangxi Regional Cooperation and Integration Promotion Investment Program (hereafter referred to as the project) in the People's Republic of China (PRC). The project in its present form consists of three tranches, each containing a number of subprojects. This IEE is prepared for tranche 1 with 10 subprojects. An environmental assessment and review framework (EARF) has also been prepared as a guidance document for the Guangxi Zhuang Autonomous Region (GZAR) government to prepare relevant environmental safeguard documents to meet Asian Development Bank's (ADB) environmental safeguard requirements for subprojects in subsequent tranches.

2. Regional cooperation and integration is an important means for the PRC to achieve greater integration with the global economic system. This has been highlighted as a priority in the 13th Five Year Plan (FYP) for 2016-2020[1], which committed the PRC to further opening up and strengthening international and regional economic cooperation, with a special focus on its neighboring countries. The proposed project aims to support participation of Guangxi in regional cooperation and integration, especially the Greater Mekong Subregion (GMS) program, with a focus on economic corridor development. The proposed project will enhance cooperation between the PRC and Viet Nam under the GMS framework, and is expected to have high regional cooperation and integration spill-overs, benefitting also Viet Nam's northern border provinces including Quang Ninh, Lang Son and Cao Bang. Regional cooperation and integration is also an integral part of ADB operations in the PRC. It is one of the five strategic priorities of the Country Partnership Strategy 2016-2020 for the PRC[2].

B. Project Design

3. The **impacts** of the project are that economic growth potential will be realized for border areas and beyond in the PRC and Viet Nam, and efficient transport and trade operations along the GMS economic corridors achieved. The **outcome** of the project is that regional cooperation and integration opportunities in border areas in Guangxi linking PRC and Viet Nam will be seized. The project will deliver five **outputs**:

   (i) Sustainable small and medium enterprise (SME) investment and development in border areas.
   (ii) Cost-competitive, safe and expeditious cross-border financial transactions and investments.
   (iii) New technologies such as e-commerce to facilitate access to markets.
   (iv) Improved connectivity in linking key economic points of interest across the border.
   (v) Well-functioning border economic zones (BEZ) with provision of key infrastructure and social and trade related services.

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[1] Government of the People's Republic of China. 2016. The 13th Five Year Plan for National Economic and Social Development.

[2] Asian Development Bank. 2016. Transforming partnership: People's Republic of China and Asian Development Bank, 2016-2020. Manila.

4. Tranche 1 consists of 10 subprojects located in the prefecture-level cities of Fangchenggang, Chongzuo and Baise in GZAR (Figure 1), providing training and border trade facilities, e-commerce and other border trade services platforms, and consulting studies and services to improve cross-border financial and business development service as well as project management (Table 1). Cross border issues are not a major concern for tranche 1 but will be considered and fully addressed during tranche 2 where relevant.

Table 1: Tranche 1 Subprojects

No.	Subproject Title	Summary of Subproject Content	Implementing Agency
1	Construction of Fangchenggang training center for Chinese and Vietnamese workers and SMEs 建设防城港中越劳务人员和中小企业培训基地	Construction and operation of training facilities on the school campus.	Fangchenggang City Poly Tech Vocational School 防城港市理工职业学校
2	Development of cross-border labor cooperation demonstration park in Pingxiang BEZ 建设凭祥跨境劳务合作示范园区	Construction and operation of facilities for skills development and exchange, training and offices in the PRC-Viet Nam cross-border labor cooperation demonstration park.	Pingxiang Urban Construction and Investment Company 凭祥市城市建设投资有限公司
3	Improvement of training for Vietnamese and Chinese workers and local SMEs 提供并改善越南劳工及中小企业培训服务	Provision of training for Vietnamese and Chinese workers and local SMEs in Fangchenggang, Chongzuo and Baise. Improvement of the design of training curriculum for Guangxi.	Guangxi Foreign Loans Project Management Office 广西国外贷款项目管理办公室
4	Expansion of SME financing in Guangxi 扩大广西中小企业融资	Partnership establishment with financial intermediaries to provide finance to SMEs in Guangxi, with focus in Fangchenggang, Chongzuo and Baise; and promotion of cross-border trade and investment.	Bank of Communications Nanning Branch 交通银行南宁支行
5	Development of smart port for Longbang BEZ 建设中国龙邦跨境经济合作区智慧口岸	Development of cross-border platforms for trade, transaction settlement, custom clearance and other items.	Baise Baidong Investment Company 百色百东投资有限公司
6	Expansion of Pingxiang border trade service center 扩建凭祥边民互市综合服务中心	Construction and operation of facilities for border trade market, warehouses, administration and services, and other ancillary facilities.	Pingxiang Urban Construction and Investment Company 凭祥市城市建设投资有限公司
7	Exploring PPP opportunities for improving border services 关于使用 PPP 模式改善口岸建设和服务的研究	Study on PPP options for tranche 2 subprojects and preparation of PPP subprojects.	Guangxi Foreign Loans Project Management Office 广西国外贷款项目管理办公室
8	Study on improving cross-border financial services and guarantees for noncommercial risks 关于改善跨境金融服务及非商业性投资风险担保的研究	Exploration of options for improving cross-border financial services and mitigating noncommercial risks for cross-border investment and financing.	Guangxi Foreign Loans Project Management Office 广西国外贷款项目管理办公室
9	Strengthening business development services in Guangxi 关于加强广西中小企业服务体系的研究	Demand analysis of SMEs in border areas for business development services. Capacity assessment of SME service centers. Formulation of strategy and action plan for improved business development services.	Guangxi Foreign Loans Project Management Office 广西国外贷款项目管理办公室
10	Institutional support for EA and IAs for project management and implementation 项目执行和实施机构能力建设与支持	Institutional support, capacity building and advisory assistance for tranche 1 subproject implementation and preparation of future tranches.	Guangxi Foreign Loans Project Management Office 广西国外贷款项目管理办公室

Notes: **BEZ** = border economic zone; **PPP** = public-private partnership; **SME** = small and medium enterprise

5. Subproject 4: Expansion of SME Financing in Guangxi will involve the Bank of Communications Nanning Branch as a financial intermediary (FI), and an environmental and social management system (ESMS) will be prepared for the FI under separate cover.

6. Three subprojects will involve civil works for the construction of training and cross-border trade services facilities in Fangchenggang and Chongzuo. They are:

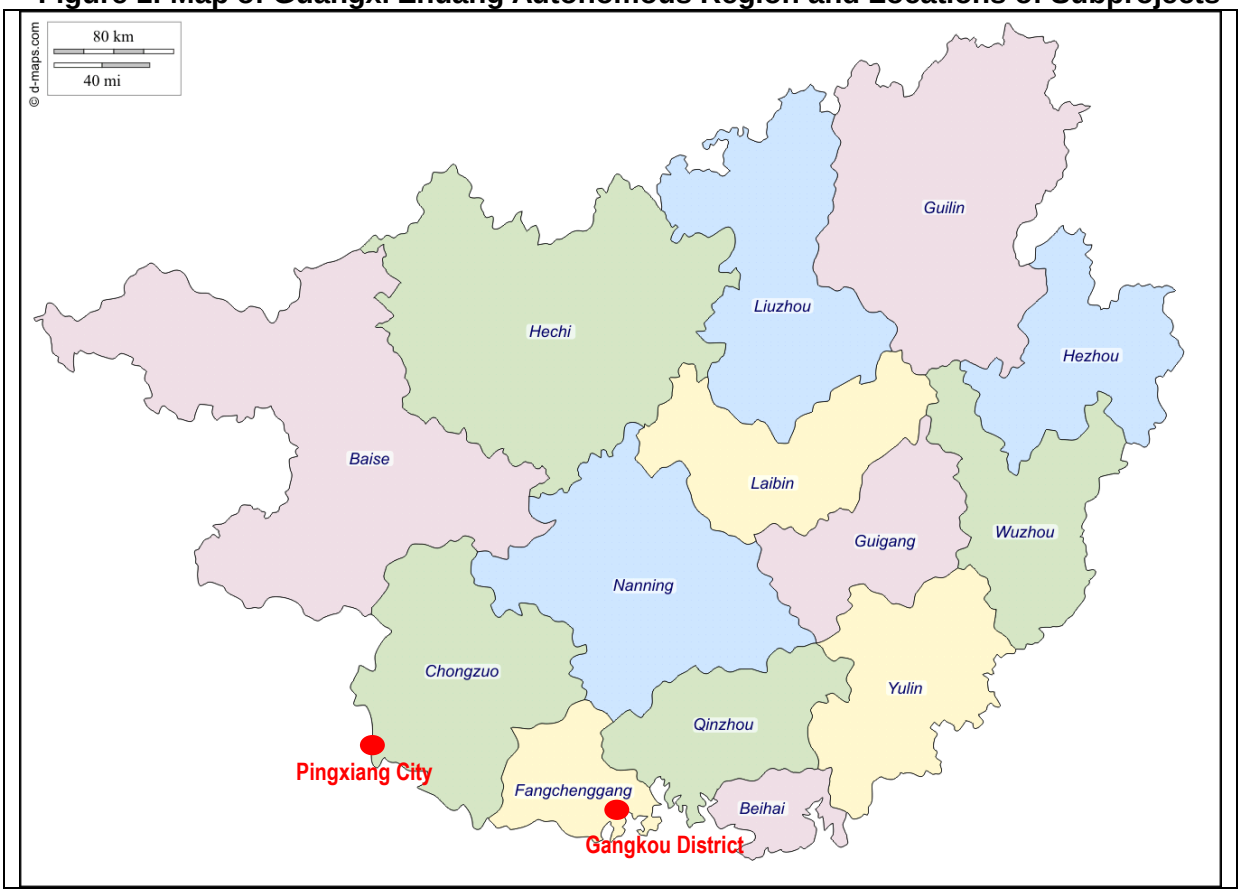
(i) **Subproject 1: Construction of Fangchenggang Training Center for Chinese and Vietnamese Workers and SMEs**. The subproject is located in the Gangkou District in

Fangchenggang. It involves the construction of five buildings of 4-6 storeys on the existing Fangchenggang Poly Tech Vocational School campus for training in trade and commerce services, student dormitories, sports management and offices.

(ii) **Subproject 2: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone**. The subproject is located in the Youyiguan Industrial Park in Pingxiang City in Chongzuo. It involves the construction of four 4-storey buildings for use as a training center, demonstration center (for product exhibition), skill development and exchange center and offices; and one 6-storey building for staff dormitory

(iii) **Subproject 6: Expansion of Pingxiang Border Trade Service Center**. The subproject is located in Pingxiang City in Chongzuo. It involves the construction of 13 buildings and facilities of 1 – 3 storeys for use as warehouse, border trade, custom declaration and inspection, banking, payment and account settlement, etc.

Figure 1: Map of Guangxi Zhuang Autonomous Region and Locations of Subprojects



7. This IEE is prepared for the above three subprojects that involve civil works, based on information provided in the corresponding feasibility study reports (FSR), environmental impact tables (EIT) and reconnaissance undertaken by the project preparation technical assistance (PPTA) consultants.

C. Project Benefits

8. This project will have the following benefits:
   (i) Improve connectivity in the border areas of Fangchenggang, Chongzuo and Baise in GZAR thus achieving better regional cooperation and investment between the PRC and Viet Nam.
   (ii) Strengthen the support for SME development in border areas.
   (iii) Attract private business into border areas through provision of efficient and cost effective cross-border financial services such as access to credit and services in cross-border payments and settlements
   (iv) Improve e-commerce platforms for cross-border trade, transaction settlement, customs clearance and other items
   (v) Improve the transport network and road conditions in the border area, and through-put capacities at selected border control points

D. Project Impacts and Mitigation Measures

9. **Air Quality and Noise**. Air and noise sensitive receptors in the vicinities of the three subprojects include ten villages with residential households and one school. Construction of subproject 1 on the Fangchenggang Poly Tech Vocational School campus would also affect the staff and students in the existing classrooms and dormitories. Dust and noise during the construction stage will need to be mitigated to reduce potential impacts to these sensitive receptors. Night time (from 22:00 to 06:00 hour) construction will be prohibited. Dust suppression and noise reduction measures during construction have been specified in the environmental management plan (EMP).

10. Operation of subproject 2, the training facilities and demonstration centre, will involve training on reprocessing and finishing of small home appliances, red wood furniture and nut product drying. Sanding, polishing and paint spraying activities in the classrooms would generate air pollutants such as volatile organic carbon (VOC), fine dust particulates and smoke that would have potential health and safety impacts to the students and teachers. Personal protection equipment (PPE) such as safety glasses, goggles, respirators and ear plugs will be provided to the teachers and students. The classrooms will also be designed with activated carbon absorbent and fabric bags to prevent VOC and fine dust from escaping into the ambient atmosphere.

11. Subproject 6, expansion of Pingxiang Border Trade Service Center, will include development of cold storage warehouse which will use liquid ammonia as a coolant. Liquid ammonia upon accidental leakage would evaporate and form ammonia gas that is an irritant and is toxic at high concentrations. The maximum storage of liquid ammonia at the cold storage will be limited to five tons at any given time, below the threshold of 10 tons for the facility to be deemed as a “major source of danger”. Environmental risk assessment undertaken by the EIT using numerical modeling to predict the dispersion of ammonia gas upon accidental leakage indicated that the impact would be confined to the first 20 minutes after leakage and within a distance of 26 m from the point of leakage. Workers within 26 m of the liquid ammonia storage room would be affected and the EMP has specified the provision of respirator and goggles in the liquid ammonia storage room for workers entering and working inside the room. None of the nearby villages would be affected. The location of the cold storage warehouse on site was also revised as a result of the EIT assessment, providing buffer distances of at least 300 m from sensitive receptors that are downwind of the highest

frequency summer wind and 150 m from sensitive receptors in other wind directions. The design for liquid ammonia storage will be in accordance with requirements for the storage and containment of hazardous waste.

12. **Water Quality**. Process wastewater and muddy runoff on construction sites would be collected and treated using sedimentation tanks. The supernatant would be used for site cleaning and dust suppression and would not be discharged. Domestic wastewater from construction workers would be treated with septic tanks on site. Domestic wastewater generated during operation of these facilities would be treated by wastewater treatment system on site. Subproject 1 has an underground wastewater treatment system on campus, whilst for subprojects 2 and 6 wastewater will be discharged to public sewers for treatment at nearby wastewater treatment plants. Wastewater from canteens would first go through oil-water separation before being discharged to sewers.

13. **Solid Waste**. Construction and demolition waste would be reused and recycled on site where practicable. Those that cannot be reused would be transported to storage or disposal centers designated by the local construction authorities. The quantities of refuse generated by construction workers on construction sites are small and would be collected regularly by local sanitation bureaus for proper disposal. Small quantities of municipal solid waste generated during operation of the facilities would also be collected regularly by local sanitation bureaus for proper disposal. Training of students on reprocessing and finishing of small home appliance in subproject 2 could produce small quantities of chemical waste, metal scraps and oily clothes. These would be collected by companies that are licensed for the collection, transportation and treatment of chemical waste.

14. **Biological Resources**. The subproject sites have been assessed in the EITs to have low ecological value. The facilities for subproject 1 will be constructed on the existing Fangchenggang Poly Tech Vocational School campus where the site has already been cleared of vegetation. Vegetation on the other two sites mainly consists of common and planted trees, shrubs and grassland. Ecological surveys and literature review by the design institutes who prepared the EITs did not reveal the presence of flora and fauna species on these sites or within the project area of influence that are under provincial, national, or international protection. These sites are not located in protected areas or critical habitats. The total land take for the three subprojects is small, approximately 16.3 ha. Upon completion of civil works, the sites will be landscaped to improve amenity and aesthetic value for users and the environment. Potential impact on biological resources and ecology is anticipated to be minimal.

15. **Physical Cultural Resources**. Assessment undertaken revealed the absence of physical cultural resources as defined in ADB's Safeguard Policy Statement (SPS, 2009) within the project area of influence of the subproject sites. Should buried artifacts of archaeological significance be uncovered during construction within the project areas, construction will be stopped and immediately reported to the local cultural bureaus in accordance with the PRC's *Cultural Relics Protection Law* (2002) and the *Cultural Relics Protection Law Implementation Ordinance* (2003).

16. **Occupational Health and Safety**. As described above, teachers and students in the training facility in subproject 2 could be exposed to VOC and fine dust particulates, and workers in and near the liquid ammonia storage room in subproject 6 could be exposed to ammonia gas if an accidental leakage occurs. The EMP has specified the provision of

training and PPE to these individuals for occupational health and safety protection.

17. **Climate Change and Adaptation Measures**. Climate risk and vulnerability assessment conducted for the three subprojects indicates that potential climate change impacts would include heavy rainfall causing flooding and landslide, sea level rise and heatwaves. Hard (engineering) and soft adaptation measures are recommended for consideration during detailed design.

E. Information Disclosure, Consultation and Participation

18. Public consultation in the form of discussion forums were conducted by the PPTA consultants on the three subprojects involving civil works in August 2016. One meeting was held in Fangchenggang for subproject 1, and two meetings were held in Pingxiang for subprojects 2 and 6, respectively. Approximately 60 people participated in the three meetings representing local village communities, enterprises and government departments. Information on subproject scopes, ADB's environmental safeguard requirements, potential environmental impacts and mitigation measures, environmental management plan (EMP) and grievance redress mechanism (GRM) was disclosed and discussed during the meetings. All participants supported the subprojects. Most of the concerns expressed by the participants were related to potential dust, noise and water quality impacts during construction; and wastewater discharge during operation. The local project management offices (PMO) and PPTA consultants advised affected persons how the concerns raised would be addressed, as documented in Chapter VII Information Disclosure, Consultation and Participation.

F. Grievance Redress Mechanism

19. This report and the EMP describe a project grievance redress mechanism to document and resolve complaints from affected persons. The GRM will be coordinated by the project management office (PMO), who will set up a complaint center with a hotline for receiving environmental and resettlement grievances which will be accessible to diverse members of the community, including vulnerable groups such as women and youth. Multiple points of entry and modes of access, including face-to-face meetings, written complaints, telephone conversations, or e-mail will be available.

G. Key EMP Implementation Responsibilities

20. The GZAR government is the executing agency (EA) and has established the PMO, who on behalf of the EA will be responsible for the day-to-day management of the project. The PMO will have overall responsibility for supervision of the implementation of environmental mitigation measures, coordinate the project level GRM, and report to ADB. PMO will appoint a staff member as an environment focal point to supervise the effective implementation of the EMP and to coordinate the project level GRM. PMO will engage the technical engineering design institutes, hire the project management consultant (PMC), and manage the procurement process. To ensure that the contractors comply with the EMP provisions, the PMO will ensure that the environmental contract clauses listed in the EMP will be incorporated into all civil works tender documents and contracts. PMO will prepare annual environment monitoring reports (EMR) with assistance from the external environmental monitor (EEM) under the PMC service and submit the EMRs to ADB.

21. The implementing agencies (IA) for the three subprojects will consist of two project implementation units (PIU). The Fangchenggang Poly Tech Vocational School will be the PIU for subproject 1. The Pingxiang Urban Construction and Investment Company will be the PIU for subprojects 2 and 6. The PIUs will each appoint a staff member as the environmental focal point to coordinate and ensure the implementation of the EMP. Each PIU will engage an external environmental supervision engineer (ESE) for independent compliance monitoring of EMP implementation. The PIUs will contract the local environmental monitoring stations (EMS) to implement environmental quality monitoring in accordance with the environmental monitoring program in the EMP.

H. Risks and Key Assurances

22. The main project risks include the low institutional capacity of the PMO, PIUs, and contractors and their failure to implement the EMP effectively during construction and operational stages. These risks will be mitigated by (i) providing training in environmental management and monitoring, (ii) appointing qualified PMC and qualified environmental focal points, (iii) following appropriate project implementation monitoring and mitigation arrangements, and (iv) ADB conducting project implementation review missions.

23. Key assurances cover ADB environmental safeguard requirements during project implementation. The EMP also includes a list of environmental contract clauses for incorporation into all civil works tender documents and contracts, thus making the implementation of environmental mitigation measures during construction legally binding for the contractors.

I. Overall Conclusion

24. This IEE shows that potential environmental impacts can be reduced to acceptable levels with appropriate mitigation. The EMP has specified mitigation measures to be implemented and responsible parties, and how the impacts are to be monitored during construction and operation. The project will have positive benefits in achieving better regional cooperation and investment between the PRC and Viet Nam by improving the skills of Chinese and Vietnamese workers and SMEs, improving the hardware and software for cross-border trade and commerce, and strengthening the support for SME development in the border areas of GZAR.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Policy Framework

25. **Regional Perspective**. The Greater Mekong Subregion (GMS) Cooperation Program envisions a subregion that is more integrated, prosperous and equitable. This vision is pursued through a “3C” strategy of enhancing connectivity, improving competitiveness, and promoting a greater sense of community. To implement this strategy, the GMS countries have adopted an economic corridor approach whereby transport corridors will be expanded, trade and investment promoted, and economic growth stimulated. The PRC and Viet Nam are active participants in developing the GMS North-South Economic Corridor.

26. As one of the two PRC provinces directly involved in the GMS cooperation, Guangxi has formulated a strategy and action plan for participation in the GMS program[3]. The medium term plan aims to (i) further enhance connectivity with the rest of the GMS; (ii) accelerate development of economic corridors with a special focus on developing border economic zones in partnership with Viet Nam; and (iii) further improve trade and investment facilitation to promote cross-border economic activities.

27. The proposed project aims to support participation of Guangxi in regional cooperation and integration, especially the GMS program, with a focus on economic corridor development. The proposed project will enhance cooperation between the PRC and Viet Nam under the GMS framework, and is expected to have high regional cooperation and integration spill-overs, benefitting also Viet Nam's northern border provinces including Quang Ninh, Lang Son and Cao Bang.

28. **PRC Perspective**. Regional cooperation and integration is an important means for the PRC to achieve greater integration with the global economic system. This has been highlighted as a priority in the 13th Five Year Plan (FYP) for 2016-2020[4], which committed the PRC to further opening up and strengthening international and regional economic cooperation, with a special focus on its neighboring countries.

29. In 2015, the PRC announced plans to develop the so-called Silk Road Economic Belt and 21st Century Maritime Silk Road (the Belt and Road Initiative)[5]. This strategic initiative aims to promote connectivity and strengthen economic partnerships between and among Asian, European and African continents in the spirit of open regionalism. It cites five priorities for cooperation: (i) fostering economic and development policy coordination; (ii) strengthening connectivity by developing energy, transport and telecommunication infrastructure and harmonizing standards; (iii) promoting trade and investment through customs, sanitary and phyto-sanitary cooperation, implementation of World Trade Organization's *Trade Facilitation Agreement*, and development of economic zones and industry clusters; (iv) deepening financial cooperation and integration; and (v) promoting people-to-people exchanges. To implement the Belt and Road Initiative, Guangxi has developed its own action plan with special emphasis on strengthening cooperation with the members of the ASEAN, particularly the GMS countries[6].

30. **ADB Perspective**. Regional cooperation and integration is an integral part of ADB operations in the PRC. It is one of the five strategic priorities of the Country Partnership Strategy 2016-2020 for the PRC[7].

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[3] Government of the Guangxi Zhuang Autonomous Region. 2014. Strategy and action plan for participation in the Greater Mekong Subregion Economic Cooperation Program, 2014-2022. Nanning.

[4] Government of the People's Republic of China. 2016. The 13th Five Year Plan for National Economic and Social Development.

[5] National Development Reform Commission, Ministry of Foreign Affairs, and Ministry of Commerce. 2015. Vision and actions on jointly building the Silk Road Economic Belt and the 21st Century Maritime Silk Road. Issued on 28 March 2015 with authorization from the State Council of the PRC.

[6] Government of the Guangxi Zhuang Autonomous Region. 2016. Recommendations on implementing the initiative of building Silk Road Economic Belt and 21st Century Maritime Silk Road. Nanning.

[7] Asian Development Bank. 2016. Transforming partnership: People's Republic of China and Asian Development Bank, 2016-2020. Manila.

B. Legal and Administrative Framework

31. The administrative framework for environmental impact assessment (EIA) in the PRC consists of national, provincial, and local (city and county) environmental protection authorities. The national authority is the Ministry of Environmental Protection (MEP), which promulgates laws, regulations, administrative decrees, technical guidelines, and environmental quality and emission standards on EIA and pollution prevention and control. At the provincial level are the Environmental Protection Departments (EPD), acting as the gatekeeper for EIA and pollution prevention and control in the province. They are often delegated the authority by MEP to approve EIA reports for development planning and construction projects in the provinces, except those with national interest and those that cross provincial boundaries that would need MEP approval. The local (city or county level) Environmental Protection Bureaus (EPB) enforce environmental laws and conduct environmental monitoring within city or county limits. Local EPBs could be delegated the authority to approve EIA reports by the provincial EPDs.

32. EPDs and EPBs are supported by Environmental Monitoring Stations (EMS), which are subsidiaries of EPDs or EPBs and are qualified entities to carry out environmental monitoring[8]. The PRC has a qualification and registration system for EIA and only qualified and registered institutes and individuals are allowed to undertake EIA. Under the recently issued *Management Measures for the Qualification of Environmental Impact Assessment for Construction Projects* (MEP decree [2015] No. 36), qualified institutes for conducting EIAs for construction projects in the PRC can no longer be a subsidiary of an environmental authority responsible for approving domestic environmental impact reports or tables as of 1 November 2015.

C. Laws, Regulations, Guidelines and Standards

33. **PRC Requirements.** Table lists the PRC's environmental laws, regulations, decrees, guidelines, and standards relevant to this project. These comprehensive requirements cover environmental protection and impact assessment; pollution prevention and control of air, noise, water, ecology and solid waste; and are supported by technical guidelines and standards for assessing atmospheric, noise, water, and ecological impacts.

Table 2: Relevant PRC Laws, Regulations, Decrees, Guidelines, and Standards

Laws	
1	*Water Pollution Prevention and Control Law*, 1984 (amended in 2008)《中华人民共和国水污染防治法》2008 修订
2	*Wild Animal Protection Law*, 1988 (amended in 2004) 《中華人民共和國野生動物保護法》2004 修订
3	*Environmental Protection Law*, 1989 (amended in 2014) 《中华人民共和国环境保护法》2014 修订
4	*Soil and Water Conservation Law*, 1991 (amended in 2010) 《中华人民共和国水土保持法》2010 修订
5	*Labor Law*, 1994 《中华人民共和国劳动法》1994
6	*Solid Waste Pollution Prevention and Control Law*, 1995 (amended in 2004) 《中华人民共和国固体废物污染防治法》2004 修订
7	*Environmental Noise Pollution Prevention and Control Law*, 1996 《中华人民共和国环境噪声污染防治法》1996
8	*Atmospheric Pollution Prevention and Control Law*, 2000 (amended in 2015) 《中华人民共和国大气污染防治法》2015 修订
9	*Occupational Disease Prevention and Control Law*, 2001 《中华人民共和国职业病防治法》2001
10	*Water Law*, 2002《中华人民共和国水法》2002

[8] In this report, "environmental monitoring" refers to the activity of collecting environmental data either through *in-situ* measurements or through sampling followed by laboratory testing of samples.

11	*Environmental Impact Assessment Law*, 2002 《中华人民共和国环境影响评价法》2002
12	*Cultural Relics Protection Law*, 2002 《中华人民共和国文物保护法》2002
Regulations	
13	*Natural Reserve Ordinance*, 1994 《中华人民共和国自然保护区条例》1994
14	*Wild Plant Protection Ordinance* 1996 《中华人民共和国野生植物保护条例》1996
15	*Construction Project Environmental Protection Management Ordinance*, 1998 《中华人民共和国建设项目环境保护管理条例》1998
16	*Cultural Relics Protection Law Implementation Ordinance*, 2003 《中华人民共和国文物保护法实施条例》2003
17	*Plan Environmental Impact Assessment Ordinance*, 2009 《中华人民共和国规划环境影响评价条例》2009
Decrees and Announcements	
18	*Circular on Strengthening the Management of Environmental Impact Assessment for Construction Projects Financed by International Financial Organizations*, (MEP Announcement [1993] No.324) 《关于加强由国际金融机构提供资金的建设项目的环境影响评估管理的通知》环发[1993]324 号
19	*Management Measures for Inspection and Acceptance of Environmental Protection at Construction Project Completion* (MEP Decree [2001] No. 13 and 2010 Amendment) 《建设项目竣工环境保护验收管理办法》环令[2001]13 号；2010 修改
20	*Specifications on the Management of Urban Construction and Demolition Waste* (Ministry of Construction Decree [2005] No. 139) 《城市建筑垃圾管理规定》建设部令[2005]139 号
21	*Management Procedures for the Supervision, Inspection and Environmental Acceptance of Construction Projects under the "Three Simultaneities"* (on trial) (MEP Announcement [2009] No. 150) 《环境保护部建设项目"三同时"监督检查和竣工环保验收管理规程（试行）的通知》环发[2009]150 号
22	*Management Measures for Operation of the Environmental Complaint Hotline* (MEP Decree [2010] No. 15) 《环保举报热线工作管理办法》环令[2010]15 号
23	*Opinion from the State Council on Important Tasks for Strengthening Environmental Protection* (State Council Announcement [2011] No. 35 《国务院关于加强环境保护重点工作的意见》国发[2011]35 号
24	*Measures for Environmental Supervision* (MEP Decree [2012] No. 21) 《环境监察办法》环境保护部令[2012]21 号
25	*Requirement for Preparation of Environmental Impact Report Summary* (MEP Announcement [2012] No. 51)《建设项目环境影响报告书简本编制要求》环告[2012]51 号
26	*Announcement on Stepping Up the Strengthening of Environmental Impact Assessment Management for Prevention of Environmental Risk* (MEP Announcement [2012] No. 77《关于进一步加强环境影响评价管理防范环境风险的通知》环发[2012]77 号
27	*Atmospheric Pollution Prevention and Control Action Plan* (State Council Announcement [2013] No. 37) 《大气污染防治行动计划》国发〔2013〕37 号
28	*Policy on Integrated Techniques for Air Pollution Prevention and Control of Small Particulates* (MEP Announcement [2013] No. 59) 《环境空气细颗粒物污染综合防治技术政策》环发[2013]59 号
29	*Guideline on Government Information Disclosure of Construction Project Environmental Impact Assessment (on trial)* (MEP Announcement [2013] No. 103) 《建设项目环境影响评价政府信息公开指南》环办[2013]103 号
30	*Directory for the Management of Construction Project Environmental Impact Assessment Categorization* (MEP Decree [2015] No. 33) 《建设项目环境影响评价分类管理名录》环令[2015]33 号
31	*Measures for Public Participation in Environmental Protection* (MEP Decree [2015] No. 35) 《环境保护公众参与办法》环令[2015]35 号
32	*Management Measures for Environmental Impact Post Assessment of Construction Projects* (on trial) (MEP decree [2015] No. 37) 《建设项目环境影响后评价管理办法（试行）》环令[2015]37 号
Guidelines	
33	HJ 2.1-2011 *Technical Guidelines for Environmental Impact Assessment – General Program*《环境影响评价技术导则 总纲》
34	HJ 2.2-2008 *Guidelines for Environmental Impact Assessment – Atmospheric Environment*《环境影响评价技术导则 大气环境》
35	HJ/T 2.3-93 *Technical Guidelines for Environmental Impact Assessment – Surface Water Environment*《环境影响评价技术导则 地面水环境》
36	HJ 2.4-2009 *Technical Guidelines for Noise Impact Assessment*《环境影响评价技术导则 声环境》
37	HJ 19-2011 *Technical Guidelines for Environmental Impact Assessment – Ecological Impact*《环境影响评价技术导则 生态影响》
38	HJ 130-2014 *Technical Guidelines for Plan Environmental Impact Assessment - General Principles*《规划环境影响评价技术导则 总纲》
39	HJ 192-2015 *Technical Criterion for Ecosystem Status Evaluation*《生态环境状况评价技术规范》
40	HJ/T 393-2007 *Technical Specifications for Urban Fugitive Dust Pollution Prevention and Control* 《防治城

	市扬尘污染技术规范》
41	HJ 610-2011 *Technical Guidelines for Environmental Impact Assessment – Groundwater Environment*《环境影响评价技术导则 地下水环境》
42	HJ 616-2011 *Guidelines for Technical Review of Environmental Impact Assessment on Construction Projects*《建设项目环境影响技术评估导则》
43	HJ 623-2011 *Standard for the Assessment of Regional Biodiversity*《区域生物多样性评价标准》
44	HJ 630-2011 *Technical Guideline on Environmental Monitoring Quality Management*《环境监测质量管理技术导则》
45	HJ 663-2013 *Technical Regulation for Ambient Air Quality Assessment* (on trial) 《环境空气质量评价技术规范（试行）》
46	HJ 710.1-2014 *Technical Guidelines on Biodiversity Monitoring - Terrestrial Vascular Plants*《生物多样性观测技术导则-陆生维管植物》
47	HJ 710.2-2014 *Technical Guidelines on Biodiversity Monitoring - Lichens and Bryophytes*《生物多样性观测技术导则-地衣和苔藓》
48	HJ 710.3-2014 *Technical Guidelines on Biodiversity Monitoring - Terrestrial Mammals* 《生物多样性观测技术导则-陆生哺乳动物》
49	HJ 710.4-2014 *Technical Guidelines on Biodiversity Monitoring - Birds*《生物多样性观测技术导则-鸟类》
50	HJ 710.5-2014 *Technical Guidelines on Biodiversity Monitoring - Reptiles*《生物多样性观测技术导则-爬行动物》
51	HJ 710.6-2014 *Technical Guidelines on Biodiversity Monitoring - Amphibians*《生物多样性观测技术导则-两栖动物》
52	HJ 710.7-2014 *Technical Guidelines on Biodiversity Monitoring - Inland Water Fish*《生物多样性观测技术导则-内陆水域鱼类》
53	HJ 710.8-2014 *Technical Guidelines on Biodiversity Monitoring - Freshwater Benthic Macroinvertebrates*《生物多样性观测技术导则-淡水底栖大型无脊椎动物》
54	HJ 710.9-2014 *Technical Guidelines on Biodiversity Monitoring - Butterflies*《生物多样性观测技术导则-蝴蝶》
55	JG/J 146-2004 *Environmental and Hygiene Standards for Construction Sites* 《建筑施工现场环境与卫生标准》
56	*Technical Guidelines for Environmental Impact Assessment - Public Participation (public comment version)*, (January 2011) 《环境影响评价技术导则 公众参与》 (征求意见稿)2011
Standards	
57	GB 3095-2012 *Ambient Air Quality Standards*《环境空气质量标准》
58	GB 3096-2008 *Environmental Quality Standard for Noise*《声环境质量标准》
59	GB 3838-2002 *Environmental Quality Standards for Surface Water*《地表水环境质量标准》
60	GB 8978-1996 *Integrated Wastewater Discharge Standard*《污水综合排放标准》
61	GB 10070-88 *Standard of Environmental Vibration in Urban Area*《城市区域环境振动标准》
62	GB 12523-2011 *Emission Standard of Environmental Noise for Boundary of Construction Site*《建筑施工场界环境噪声排放标准》
63	GB/T 14529-93 *Principle for Categories and Grades of Nature Reserves* 《自然保护区类型与级别划分原则》
64	GB 14554-93 *Emission Standards for Odor Pollutants*《恶臭污染物排放标准》
65	GB/T 14848-93 *Quality Standard for Ground Water* 《地下水质量标准》
66	GB/T 15190-2014 *Technical Specifications for Regionalizing Environmental Noise Function* 《声环境功能区划分技术规范》
67	GB 15618-1995 *Environmental Quality Standard for Soils* 《土壤环境质量标准》
68	GB 16297-1996 *Air Pollutant Integrated Emission Standards* 《大气污染物综合排放标准》
69	GB 22337-2008 *Emission Standard for Community Noise* 《社会生活环境噪声排放标准》
70	GB 50118-2010 *Design Specifications for Noise Insulation of Buildings for Civil Use* 《民用建筑隔声设计规范》

34. **Environmental Protection.** The most far-reaching law on pollution prevention and control is the *Environmental Protection Law* (EPL) (1989, amended in 2014) (item #3 in Table 2). When promulgated in 1989, it set out key principles for the nation's pollution control system, including the policy known as the "Three Simultaneities,[9]" the application of pollution levy, and requirements for EIA. The EPL was amended in 2014 and the amended EPL took effect on 1 January 2015. The implementation of "Three Simultaneities" was further strengthened by the decree on its management procedures (items #19 and #21) and the *Construction*

[9] The "Three Simultaneities Policy" requires the design, construction, and operation of pollution control and treatment facilities to occur simultaneously with the project design, construction, and operation.

Project Environmental Protection Management Ordinance (item #15).

35. Public Participation and Environmental Information Disclosure provisions are among the most significant changes introduced in the amended EPL, further supported by the decrees on the preparation of EIA summaries for the purpose of public disclosure (item #25), information disclosure on construction project EIAs by government (item #29), method for public participation in environmental protection (item #31), and technical guidelines (for comment) for public participation in EIAs (item #56).

36. The amended EPL further defines enforcement and supervision responsibilities of all levels of environmental protection authorities, imposes stricter obligations and more severe penalties on enterprises and construction units regarding pollution prevention and control, and allows for environmental public interest litigation including through nongovernment organizations. The procedures and requirements for the technical review of EIA reports by authorities have been specified (item #43). Environmental inspection and enforcement on design, installation, and operation of project-specific environmental protection and control measures are regulated under the "Three Simultaneities" (items #3, #15, #19, #21, and #24).

37. For grievance redress, a hotline number 12369 has been established at each level of environmental protection authority throughout the nation since March 2011 for receiving and resolving environmental complaints in accordance with the *Management Measures for Operation of the Environmental Complaint Hotline* (MEP Decree [2010] No. 15] (item #22).

38. The EPL also provides protection for community health, with protection of occupational health and safety provided by the *Labor Law* (1994) (item #5), the *Occupational Disease Prevention and Control Law* (2001) (item #9), and environmental and hygiene standards for construction sites (item #55).

39. **Environmental Impact Assessment.** EIA is governed by the *Environmental Impact Assessment Law* (2002) (item #11), covering EIAs for (i) plans (such as new development areas and new industrial parks) and strategic studies which could also be deemed as strategic environmental assessments (SEA), and (ii) construction projects. This was followed by the promulgation of two regulations: the *Construction Project Environmental Protection Management Ordinance* (1998) (item #15) and the *Plan Environmental Impact Assessment Ordinance* (2009) (item #17). Both require early screening and environmental categorization.

40. A recent MEP decree, the *Directory for the Management of Construction Project Environmental Impact Assessment Categorization* (MEP Decree [2015] No. 33) (item #30), classifies EIAs for construction projects into three categories with different reporting requirements, based on the "significance" of potential environmental impact due to the project and the environmental sensitivity of the project site as described in this directory. An EIR is required for construction projects with potential significant environmental impacts. An EIT is required for construction projects with less significant environmental impacts. An EIRF is required for construction projects with the least significant environmental impacts. Environmentally sensitive areas, as defined in the Decree, include three categories: (i) nature reserves and protected areas, scenic areas, world cultural and natural heritage sites, drinking water source protection zones; (ii) basic farmland and grassland, forest parks, geological parks, important wetland, natural woodland, critical habitats for endangered plant and animal species, important aquatic spawning/nursery/ wintering/migration grounds, regions suffering from water resource shortage, serious soil erosion areas, desertification

protection areas, eutrophic water bodies; and (iii) inhabited areas with major residential, health care, scientific research, and administration functions, cultural heritage protection sites, and protection areas with historical, cultural, scientific, and ethnic values.

41. **Follow-Up Actions on Environmental Impact Assessment.** In 2015, MEP issued a decree, *Management Measures for Environmental Impact Post Assessment of Construction Projects* (MEP decree [2015] No. 37) (item #32) to have, on a trial basis and effective 1 January 2016, follow-up actions between 3 to 5 years after commencement of project operation for large infrastructure and industrial projects or projects located in environmentally sensitive areas. Such actions would include environmental monitoring and impact assessment to verify the effectiveness of environmental protection measures and to undertake any corrective actions that might be needed. The decree also specifies that the institute that does the original impact assessment for the project cannot undertake environmental impact post assessment for the same project.

42. **Guidelines and Standards.** MEP has issued a series of technical guidelines for preparing EIAs. These include impact assessment guidelines on general EIA program and principles (items #33 and #38), atmospheric environment (item #34) and ambient air quality (item #46), noise (item #36), surface water (item #35), ground water (item #41), ecology (items #37 and #39) and regional biodiversity (item #43), biodiversity monitoring of various biota (items #46 to #54), quality management on environmental monitoring (item #44), and public participation (item #56). Standards issued by MEP generally consist of environmental quality (ambient) standards (applicable to the receiving end) and emission standards (applicable to the pollution source). The former includes standards for ambient air quality (item #57), noise (item #58) and vibration (item #61), surface water (item #59), groundwater (item #65), soil (item #67), etc. The latter includes standards for integrated wastewater discharge (item #60), construction noise (item #62) and community noise (item #69), odor (#64) and air pollutants (#68), etc.

43. **ADB Environmental Safeguard Requirements.** The proposed project is classified as category B for environment for tranche 1 subprojects as it is considered that the tranche 1 subprojects are unlikely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. This project therefore requires the preparation of an IEE report for tranche 1 which includes an EMP. ADB's SPS 2009 requires a number of considerations that are over and above the domestic EIR or EIT requirements. These include, among others, (i) project risks and respective mitigation measures and project assurances; (ii) project-level GRM; (iii) definition of the project area of influence; (iv) consideration of physical cultural resources; (v) climate change mitigation and adaptation; (vi) occupational and community health and safety requirements; (vii) economic displacement that is not part of land acquisition; (viii) consideration of biodiversity conservation and natural resources management requirements; (ix) provision of justification if local environmental quality standards are used; (x) meaningful consultation and participation; and (xi) implementation schedule and (measurable) performance indicators in the EMP. An environmental assessment and review framework (EARF) has been prepared to guide the EA in conducting rapid environmental assessment for categorization and in preparation of EIA or IEE for tranches 2 and 3.

44. **Relevant International Agreements.** The PRC is a signatory to a number of international agreements relevant to environment protection. Those relevant to the project, along with the dates of signing by the PRC, are listed in Table 3.

Table 3: International Agreements with the PRC as a Signatory

No.	Name of Agreement	PRC Signing Date	Agreement Objective
1	*Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat*	1975.12.21	To stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the wetlands' ecological functions and their economic, cultural, scientific, and recreational values
2	*Montreal Protocol on Substances That Deplete the Ozone Layer*	1989.01.01	To protect the ozone layer by controlling emissions of substances that deplete it
3	*Convention on Biological Diversity*	1993.12.29	To develop national strategies for the conservation and sustainable use of biological diversity
4	*United Nations Framework Convention on Climate Change*	1994.03.21	To achieve stabilization of greenhouse gas concentrations in the atmosphere at a low enough level to prevent dangerous anthropogenic interference with the climate system
5	*United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification*	1996.12.26	To combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements
6	*Kyoto Protocol to the United Nations Framework Convention on Climate Change*	2005.02.23	To further reduce greenhouse gas emissions by enhancing the national programs of developed countries aimed at this goal and by establishing percentage reduction targets for the developed countries

D. Evaluation Standards

45. In the PRC, ambient conditions of air, noise, and water quality in the project area determine the appropriate category of emissions and effluent standards for the construction and operational phases of built infrastructure. The World Bank Group (WBG) Environmental Health and Safety (EHS) guidelines[10] (see below) are based on international best practice construction and operational procedures. Both the PRC standards and EHS guidelines are used in the assessments.

46. **Air Quality.** The PRC ranks air quality into two classes according to its *Ambient Air Quality Standard* (GB 3095-2012). Class I standard applies to nature reserves, scenic areas, and regions requiring special protection. Class II standard applies to residential areas, mixed residential/commercial areas, cultural areas, industrial zones, and rural areas. The ambient air quality in the assessment area of this project has been assigned to meet GB 3095-2012 Class II standards. The WBG adopted the World Health Organization (WHO) standards for its EHS standards for air quality.

47. On 10 September 2013, the State Council announced the *Atmospheric Pollution Prevention and Control Action Plan* for the PRC (State Council Announcement [2013] No. 37) (see Table 1, item #34). The action plan sets 2017 targets on reducing PM_{10} emissions in prefecture level cities by more than 10%; $PM_{2.5}$ emissions by approximately 25%, 20% and 15% in Beijing-Tianjin-Hebei region, Yangtze River Delta, and Pearl River Delta respectively; and controlling annual average $PM_{2.5}$ levels in Beijing at around 60 μg/m^3. Among the 35 actions identified and described in the plan, the followings are relevant to this project:

[10] World Bank Group. 2007. Environmental, health and safety guidelines-General EHS guidelines. Washington, DC

(i) Strengthen control of aerial sources of pollution including controlling dust pollution during construction;
(ii) Strictly implement total emission pollution control on SO_2, NO_x, dust, and volatile organics as a pre-requisite in approving construction project EIRs;
(iii) Optimize spatial pattern in urban and new district planning to facilitate better air pollutant dispersion;
(iv) Strengthen laws, regulations and standards on controlling air pollution;
(v) Strengthen capacities in environmental management and supervision system;
(vi) Increase environmental regulatory enforcement;
(vii) Implement environmental information disclosure;
(viii) Strictly enforce accountability;
(ix) Establish monitoring warning system;
(x) Develop contingency plan; and
(xi) Adopt timely contingency measures for public health protection during serious air pollution events.

48. The WHO established air quality guideline (AQG) standards for various air quality parameters for the protection of public health. Yet recognizing that progressive actions are needed to achieve these standards and the financial and technological limitations of some countries, cities or localities especially in developing countries, the WHO also established interim targets as intermediate milestones towards achieving the AQG.

49. Table 4 compares PRC's GB 3095–2012 *Ambient Air Quality Standards* and the World Bank Group's EHS standard which has adopted the WHO AQG. The longer averaging period such as 1 year is more applicable to assessing impacts from multiple as well as regional sources; while shorter averaging periods such as 24 hours and 1 hour are more applicable to assessing short-term impacts from project-related activities, such as from peak hour traffic or daily or peak construction activities.

Table 4: Comparison of PRC and WBG Ambient Air Quality Standards

Air Quality Parameter	Averaging Period	PRC GB 3095-2012 (μg/m^3)		WHO/World Bank Group EHS[11] (μg/m^3)	
		Class I	Class II	Interim Targets	AQG
SO_2	1-year	20	60	n/a	n/a
	24-hour	50	150	50 - 125	20
	1-hour	150	500	n/a	n/a
TSP	1-year	80	200	n/a	n/a
	24-hour	120	300	n/a	n/a
PM_{10}	1-year	40	70	30 - 70	20
	24-hour	50	150	75 - 150	50
$PM_{2.5}$	1-year	15	35	15 - 35	10
	24-hr	35	75	37.5 - 75	25
NO_2	1-year	40	40	n/a	40
	24-hour	80	80	n/a	n/a
	1-hour	200	200	n/a	200
CO	24-hour	4,000	4,000	n/a	n/a
	1-hour	10,000	10,000	n/a	n/a
Note: n/a = not available					

[11] World Bank Group 2007, ibid.

50. The following observations are made comparing PRC and WBG ambient air quality standards as shown in Table 4, showing that WBG interim targets are comparable to PRC's GB 3095–2012 Class II standards:

    (i) 24-hr SO_2: upper limit of EHS interim target (125 μg/m^3) is more stringent than GB Class II standard (150 μg/m^3);
    (ii) 24-hour PM_{10}: the upper limit of the EHS interim target (125 μg/m^3) is the same as GB Class II standard;
    (iii) 24-hr $PM_{2.5}$: the upper limit of the EHS interim target (75 μg/m^3) is the same as GB Class II standard; and
    (iv) 24-hour NO_2: the EHS AQG (200 μg/m^3) is the same as GB Class II standard.

51. Emission standards of fugitive particulate matter (such as dust) from construction sites are regulated under the PRC's *Air Pollutant Integrated Emission Standard* (GB 16297–1996). For particulate matter, the maximum allowable emission concentration is 120 mg/m^3 and the concentration limit at the boundary of construction sites is ≤ 1.0 mg/m^3, with no specification on the particulate matter's particle diameter.

52. **Noise.** GB 3096–2008 categorizes five functional areas based on their tolerance to noise pollution: from Category 0 to Category 4. Category 0 is for areas with convalescent facilities that are the least tolerant to noisy environment and therefore has the most stringent day and night time noise standards. Category 1 is for areas predominated by residential areas, hospitals and clinics, educational institutions, and research centers. Category 2 is for areas with mixed residential and commercial functions. Category 3 is for areas with industrial production and storage and logistics functions. Category 4 is for regions adjacent to traffic noise sources such as major roads and railways, and is subdivided into 4a and 4b with the former applicable to major road (road class II and above) and marine traffic noise, and the latter applicable to rail noise.

53. Standards for various functional area categories are compared with the WBG's EHS guidelines in Table 5, showing that the EHS guidelines have lower noise limits for residential, commercial, and industrial mixed areas but higher noise limits for industrial areas. The EHS guidelines do not have separate noise limits for major roads but apply the same noise limits based on whether the areas are for residential or industrial use.

Table 5: Environmental Quality Standards for Noise [L_{Aeq}: dB(A)]

Noise Functional Area Category	Applicable Area	GB 3096-2008 Standards		WBG EHS[12] Standards	
		Day 06:00-22:00	Night 22:00-06:00	Day 07:00-22:00	Night 22:00-07:00
0	Areas needing extreme quiet, such as convalescence areas	50	40	55	45
1	Areas mainly for residence, hospitals, cultural and educational institutions, administration offices	55	45		
2	Residential, commercial and industrial mixed areas	60	50		
3	Industrial areas, warehouses and logistic parks	65	55	70	70
4a	Area within 35 m on both sides of trunk road (class II and above)	70	55	55	45

54. The PRC's *Emission Standard of Environmental Noise for Boundary of Construction Site* (GB 12523–2011) regulates construction noise, limiting construction noise levels at the construction site boundary to 70 dB(A) in the day time (0600–2200 hours) and 55 dB(A) at night (2200–0600 hours). The WBG does not have standards for construction noise *per se*, but applies the same noise standards listed in Table 5 above to the receptors during construction activities.

55. **Surface Water Quality.** For water quality assessment, the determining standard is the PRC's *Environmental Quality Standards for Surface Water* (GB 3838–2002) (Table 6). It defines five water quality categories for different environmental functions. Category I is the best, suitable for head waters and national nature reserves. Category II is suitable for drinking water sources in Class I protection areas, habitats for rare aquatic organisms, breeding grounds for fish and crustaceans, and feeding grounds for fish fry. Category III is suitable for drinking water sources in Class II protection areas, wintering grounds for fish and crustaceans, migration routes, water bodies for aquaculture and capture fishery, and swimming activities. Category IV is suitable for general industrial use and non-contact recreational activities. Category V is the worst which is only suitable for agricultural and scenic water uses.

Table 6: Environmental Quality Standards for Surface Water GB 3838–2002

Parameter	Water Quality Category				
	I	II	III	IV	V
pH	6 ~ 9	6 ~ 9	6 ~ 9	6 ~ 9	6 ~ 9
Dissolved oxygen (DO) [mg/L]	90% saturation or ≥7.5	≥6	≥5	≥3	≥2
Permanganate index (I_{Mn}) [mg/L]	≤2	≤4	≤6	≤10	≤15
Chemical oxygen demand (COD) [mg/L]	≤15	≤15	≤20	≤30	≤40
5-day Biochemical oxygen demand (BOD_5) [mg/L]	≤3	≤3	≤4	≤6	≤10
Ammonia nitrogen (NH_3-N) [mg/L]	≤0.15	≤0.5	≤1.0	≤1.5	≤2.0
Total phosphorus (as P) [mg/L]	≤0.02	≤0.1	≤0.2	≤0.3	≤0.4
Lakes & reservoirs	≤0.01	≤0.025	≤0.05	≤0.1	≤0.2
Total nitrogen (lakes, reservoirs, as N) [mg/L]	≤0.2	≤0.5	≤1.0	≤1.5	≤2.0
Copper (Cu) [mg/L]	≤0.01	≤1.0	≤1.0	≤1.0	≤1.0
Zinc (Zn) [mg/L]	≤0.05	≤1.0	≤1.0	≤2.0	≤2.0
Fluoride (as F^-) [mg/L]	≤1.0	≤1.0	≤1.0	≤1.5	≤1.5
Selenium (Se) [mg/L]	≤0.01	≤0.01	≤0.01	≤0.02	≤0.02

[12] World Bank Group 2007, ibid.

Parameter	Water Quality Category				
	I	II	III	IV	V
Arsenic (As) [mg/L]	≤0.05	≤0.05	≤0.05	≤0.1	≤0.1
Mercury (Hg) [mg/L]	≤0.0005	≤0.0005	≤0.0001	≤0.001	≤0.001
Cadmium (Cd) [mg/L]	≤0.001	≤0.005	≤0.005	≤0.005	≤0.01
Chromium (Cr, hexavalent) [mg/L]	≤0.01	≤0.05	≤0.05	≤0.05	≤0.1
Lead (Pb) [mg/L]	≤0.01	≤0.01	≤0.05	≤0.05	≤0.1
Cyanide (CN) [mg/L]	≤0.005	≤0.05	≤0.2	≤0.2	≤0.2
Volatile phenol [mg/L]	≤0.002	≤0.002	≤0.005	≤0.01	≤0.1
Total petroleum hydrocarbon (TPH) [mg/L]	≤0.05	≤0.05	≤0.05	≤0.5	≤1.0
Anionic surfactant (=LAS) [mg/L]	≤0.2	≤0.2	≤0.2	≤0.3	≤0.3
Sulfide [mg/L]	≤0.05	≤0.1	≤0.2	≤0.5	≤1.0
Fecal coliform bacteria [number/L]	≤200	≤2000	≤10000	≤20000	≤40000

56. Discharge of wastewater from construction sites is regulated under the PRC's *Integrated Wastewater Discharge Standard* (GB 8978–1996) (Table 7). Class 1 standard applies to discharge into Category III water bodies under GB 3838–2002. Class 2 standard applies to discharge into categories IV and V water bodies. Class 3 standard applies to discharge into municipal sewers going to municipal wastewater treatment plants (WWTPs) with secondary treatment. No new discharge of wastewater into Categories I and II water bodies is allowed. The WBG does not have ambient water quality standard, and recognizes the use of national and local ambient water quality criteria for EHS purpose.

Table 7: Standards for Discharging Wastewater from Construction Sites GB 8978–1996

Parameter		Class 1	Class 2	Class 3
		(for discharging into Category III water body)	(for discharging into Categories IV and V water body)	(for discharging into municipal sewer)
pH	no unit	6 ~ 9	6 ~ 9	6 ~ 9
SS	mg/L	70	150	400
BOD_5	mg/L	20	30	300
COD	mg/L	100	150	500
TPH	mg/L	5	10	20
Volatile phenol	mg/L	0.5	0.5	2.0
NH_3-N	mg/L	15	25	---
PO_4^{2-} (as P)	mg/L	0.5	1.0	---
LAS (= anionic surfactant)	mg/L	5.0	10	20

57. **Soil Quality**. Soil quality in the PRC is divided into three classes according to the *Environmental Quality Standard for Soils* (GB 15618-1995). Class 1 represents the best and Class 3 the worst (Table 8). The WBG does not have EHS standards for soil quality.

Table 8: Soil Quality Standard GB 15618-1995

Parameter		Maximum Allowable Concentration (mg/kg dry weight)				
		Class 1	Class 2			Class 3
	Soil pH	Back ground	<6.5	6.5~7.5	>7.5	>6.5
Cadmium (Cd)		0.20	0.30	0.30	0.60	1.0
Mercury (Hg)		0.15	0.30	0.50	1.0	1.5
Arsenic (As)	Paddy	15	30	25	20	30
	Dry land	15	40	30	25	40
Copper (Cu)	Farm land	35	50	100	100	400
	Orchard	---	150	200	200	400
Lead (Pb)		35	250	300	350	500
Chromium (Cr)	Paddy	90	250	300	350	400
	Dry land	90	150	200	250	300
Zinc (Zn)		100	200	250	300	500

Parameter	Maximum Allowable Concentration (mg/kg dry weight)				
	Class 1	Class 2			Class 3
Soil pH	Back ground	<6.5	6.5~7.5	>7.5	>6.5
Nickel (Ni)	40	40	50	60	200
DDT	0.05	0.50			1.0
666 (Lindane)	0.05	0.50			1.0

E. Assessment Area (Project Area of Influence), Assessment Period, and Evaluation Standards for the Project

58. The assessment area, or the project area of influence, was determined based on potential impact distances of various environmental parameters, the assessment levels assigned by the local environmental authorities for various environmental media, and guidance provided in the PRC's series of Technical Guidelines for EIA (see Table 2, items #33-37). Table 9 shows the assessment areas and the PRC evaluation standards adopted for this project. A comparison of the PRC standards with internationally accepted standards (as defined in the World Bank's Environment Health and Safety Guidelines) was conducted for the IEE. The comparison confirmed that the PRC standards are either internationally accepted or have comparable standard limits with most of the international standards.

Table 9: Assessment Area and PRC Evaluation Standards Adopted for this Project

Type of Standard	Environmental Media	Applicable PRC Standard	Project Area of Influence
Environmental quality standard	Ambient air quality	Class II standard in *Ambient Air Quality Standard* (GB 3095-2012)	Up to 200 m beyond the "footprint" of the permanent and temporary land take areas
	Noise	Functional Area Category 2 standard in *Environmental Quality Standard for Noise* (GB 3096-2008)	Up to 200 m beyond the "footprint" of the permanent and temporary land take areas
	Surface water quality	Categories III, IV and V standards in *Environmental Quality Standards for Surface Water* (GB 3838-2002) depending on the water quality category of the water body.	Up to 300 m beyond the "footprint" of the permanent and temporary land take areas
	Ecology	No numerical standard. Assessment based on *Technical Guidelines for Environmental Impact Assessment – Ecological Impact* (HJ 19-2011)	"Footprint" of the permanent and temporary land take areas
	Physical cultural resources	No numerical standard but controlled under PRC's *Cultural Relics Protection Law* and *Cultural Relics Protection Law Implementation Ordinance.*	"Footprint" of the permanent and temporary land take areas
	Occupational health and safety	No numerical standard but controlled under PRC's *Labor Law* and *Environmental and Hygiene Standards for Construction Sites* (JG/J 146-2004)	Construction sites within the "footprint" of the permanent and temporary land take areas
	Community health and safety	No numerical standard	Up to 200 m beyond the "footprint" of the permanent and temporary land take areas
Pollutant emission standard	Air pollutant	*Air Pollutant Integrated Emission Standard* (GB 16297-1996), Class II and fugitive emission standards	Construction sites within the "footprint" of the permanent and temporary land take areas
	Noise	*Emission Standard of Environmental Noise for Boundary of Construction Site* (GB 12523-2011)	Construction sites within the "footprint" of the permanent and temporary land take areas
	Wastewater	*Integrated Wastewater Discharge Standard* (GB 8978-1996): (i) Class 1 standard for	Construction sites within the "footprint" of the permanent and temporary land

Type of Standard	Environmental Media	Applicable PRC Standard	Project Area of Influence
		discharging into Category III water bodies; (ii)Class 2 standard for discharging into Categories IV and V water bodies; (iii) Class 3 standard for discharging into municipal sewers; (iv) No discharge into Categories I and II water bodies.	take areas during construction. Effluent discharge standards for the facilities during operation

59. The assessment period covers both construction (ranging from seven to twenty-two months) and operation (first three years after commissioning) stages of the subprojects with civil works proposed for Tranche 1. For subproject 1: Construction of Fangchenggang Training Center for Chinese and Vietnamese Workers and SMEs, the construction duration for the whole campus would take approximately 24 months, and the construction of the subproject facilities would take approximately 12 months within this period. For subproject 2: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone, the construction duration would take approximately 22 months. For subproject 6: Expansion of Pingxiang Border Trade Service Center, the construction duration would take approximately seven months.

F. Justification for the Use of PRC Standards

60. ADB's *Safeguard Policy Statement (2009)* requires projects to apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's *Environmental, Health and Safety Guidelines*. Table 9 compares PRC standards with the World Bank Group's EHS guidelines, and concludes that the application of PRC legislated standards was justified. The justification is based on several observations:

61. The World Bank Group's EHS guidelines endorses the use of internationally recognized standards in case of absence of national legislated standards. In this project, this clause applies to ambient air quality and ambient water quality standards: (i) The General EHS Guidelines on Air Emissions and Ambient Air Quality state that "Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should [apply] national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources". The availability of national legislated standards overrides the adoption of other internationally recognized standards; (ii) The General EHS Guidelines on Air Emissions and Ambient Air Quality state that "Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources". The availability of national legislated standards overrides the adoption of other internationally recognized standards.

62. **Some PRC standards are more stringent than internationally accepted standards.** PRC standards of relevance to the project include ambient CO and NO_2 concentrations (Table 10).

63. **PRC standards are not always comparable to standards suggested in the World Bank**

Group's EHS Guidelines. Some ambient air quality standards, including NO_2 and H_2S, are defined for different time periods (exposures), and are thus not directly comparable (see Table 9). PRC ambient acoustic quality standards are defined for categories as well as by taking into consideration influencing factors such as road and rail traffic, and are different to the classification of the World Health Organization that does not take influencing factors into consideration. As standard limits are not significantly different (e.g. noise levels), a shift to alternate classifications or time periods, which would require an adaptation of the monitoring procedures by nationally accredited monitoring stations, does not seem to be justified.

64. **Some PRC standards are not defined in the World Bank Group's EHS Guidelines.** Internationally accepted standards for NH_3 and TSP, which are defined in PRC ambient air quality standards, could not be identified. Other parameters which could not be compared to international standards include surface and marine water quality standards.

Table 10: Comparison of PRC Standards with World Bank Group's EHS Guideline

Parameter	PRC standards	International standards	*Remarks*
Ambient Air Quality	**GB-3095-2012**	**WHO Air Quality Guidelines Global Update (2005); USEPA**	
TSP	0.12 mg/m^3 (Class I, 24h) 0.30 mg/m^3 (Class II, 24h)	WHO: No standard USEPA: No standard	*No comparison possible*
CO	4.0 mg/m^3 (Class I, 24h) 4.0 mg/m^3 (Class II, 24h)	WHO: No standard USEPA: 10 mg/m^3	*PRC standard is more stringent than USEPA*
NO_2	0.08 mg/m^3 (Class I, 24h) 0.08 mg/m^3 (Class II, 24h) 0.20 mg/m^3 (Class I, 1h) 0.20 mg/m^3 (Class II, 1h)	WHO: 0.04 mg/m^3 (365d); 0.20 mg/m3 (1h) USEPA: 0.14 mg/m^3 (24h)	*PRC and WHO standards are either not compatible given the different time periods, or the same for same time period.* *PRC standard is more stringent than USEPA standard*
PM_{10}	0.05 mg/m^3 (Class I, 24h) 0.15 mg/m^3 (Class II, 24h)	WHO: 0.05 mg/m^3 (24h) USEPA: 0.15 mg/m^3 (24h)	*PRC standards are comparable to EPA standard.*
Ambient Acoustic Quality Standard	**GB-3096-2008**	**World Health Organization (1999)**	
L_{Aeq} (dBA)	45/55 (night/day, Category 1) 50/60 (night/day, Category 2) 55/65 (night/day, Category 3) 55/70 (night/day, Category 4a) 60/70 (night/day, Category 4b)	Class I: 45/55 (night/day) Class II: 70/70 (night/day)	*WHO Class I: Residential, institutional, educational* *WHO Class II: Industrial, commercial*
Surface Water Quality Standard	**GB-3838-2002**		*No comparable standard identified/suggested in the EHS guideline*
COD	15 mg/L (Category II) 20 mg/L (Category III) 30 mg/L (Category IV)		
NH_3-N	0.5 mg/L (Category II) 1.0 mg/L (Category III) 1.5 mg/L (Category IV)		
TP	0.1 mg/L (Category II) 0.2 mg/L (Category III) 0.3 mg/L (Category IV)		

Parameter	PRC standards	International standards	*Remarks*
Sea Water Quality Standard	**GB-3097-1997**		*No comparable standard identified/suggested in the EHS guideline*
COD	2 mg/L (Category I) 3 mg/L (Category II) 4 mg/L (Category III) 5 mg/L (Category IV)		
Inorganic. N	0.2 mg/L (Category I) 0.3 mg/L (Category II) 0.4 mg/L Category III) 0.5 mg/L (Category IV)		
Active P	0.015 mg/L (Category I) 0.030 mg/L (Category II) 0.030 mg/L (Category III) 0.045 mg/L (Category IV)		
Noise Standards for Industrial Enterprise Boundary	**GB 12348-2008**	**World Health Organization (1999)**	*WHO Class I: Residential, institutional, educational* *WHO Class II: Industrial, commercial*
L_{Aeq} (dBA)	55/45 (day/night, Class I) 60/50 (day/night, Class II) 65/55 (day/night, Class III) 70/55 (day/night, Class IV)	Class I: 45/55 (night/day) Class II: 70/70 (night/day)	
Noise Limits for Construction Sites	**GB 12523-1990**	**USEPA**	
L_{Aeq} (dBA)	75/55 (Earth works, day/night) 85 (Pile driving, day; banned for night) 70/55 (Structural works, day/night) 65/55 (Exterior and interior finishing works, day/night)	85 (day, 8h exposure)	

III. DESCRIPTION OF THE PROJECT

A. General

65. The proposed project consists of 10 subprojects in Tranche 1 (see Table 1). Of these, subprojects 1, 2 and 6 will involve the construction and operation of facilities/buildings during which potential environmental impacts could be generated. The other seven subprojects will involve the provision of equipment and services in existing facilities, consulting studies and consulting services which would not have potential environmental impacts. This IEE and attached EMP therefore focus on assessing and mitigating potential environmental impacts during construction and operation of the facilities in subprojects 1, 2 and 6. For subproject 4 which involves the Bank of Communications Nanning Branch as a financial intermediary (FI), an environmental and social management system (ESMS) will be developed for the FI under separate cover.

66. Table 11 shows domestic environmental assessment reporting and approval for the three subprojects with construction activities. Three environmental impact tables (EITs) have been prepared in accordance with the requirements in the *Directory for the Management of Construction Project Environmental Impact Assessment Categorization* (MEP Decree [2015] No. 33) (item #30 in Table 2). The approval authorities for these EITs are the respective city EPBs. This IEE is prepared based on information provided in these EITs, feasibility study

reports (FSRs) for these three subprojects, as well as site reconnaissance by the PPTA consultants.

Table 11: Domestic Environmental Assessment Reporting for Tranche 1 Subprojects

Tranche 1 Subproject		Reporting Category	Preparation		Approval	
No.	Title		By	Date	By	Date
1	Construction of Fangchenggang training center for Chinese and Vietnamese workers and SMEs 建设防城港中越劳务人员和中小企业培训基地	EIT (for whole campus)	Fangchenggang Environmental Science Research Institute 防城港市环境科学研究所	April 2013	Fangchenggang EPB	2013.05.28
2	Development of cross-border labor cooperation demonstration park in Pingxiang BEZ 建设凭祥跨境劳务合作示范园区	EIT	Hunan Lvhong Environmental Technology Co. Ltd. 湖南绿鸿环境科技有限责任公司	August 2016	Pingxiang EPB	2016.10.12
6	Expansion of Pingxiang border trade service center 扩建凭祥边民互市综合服务中心	EIT	Hunan Lvhong Environmental Technology Co. Ltd. 湖南绿鸿环境科技有限责任公司	May 2016	Pingxiang EPB	2016.07.27

Notes: **BEZ** = border economic zone; **EIT** = environmental impact table; **EPB** = Environmental Protection Bureau; **SME** = small and medium enterprise

Source: EITs

B. Project Rationale

67. **Unrealized Potential in Regional Cooperation and Investment**. The border areas of both the PRC and Viet Nam have been identified as key areas of accelerated development, taking advantage of opportunities offered by regional cooperation and investment, particularly in terms of improving cross-border connectivity and promoting cross-border economic activities. However, opportunities for regional cooperation and investment in the border areas of Guangxi and its neighboring provinces in Viet Nam have not been fully tapped. This has resulted in inefficient transport and trade operations along the GMS North-South Economic Corridor and unrealized economic growth potential in the border areas and beyond in both Guangxi and northern Viet Nam. This project will improve connectivity in these border areas thus achieving better regional cooperation and investment.

68. **Difficulties in Attracting Investment for Small and Medium Enterprises (SMEs) in Border Areas**. SMEs are generally less developed in border areas with weaker capacities and competitiveness, especially in their start-up phases. They have limited access to bank credit and often have difficulties in hiring and retaining managerial staff and skilled labor. This project will provide support to help these SMEs operate in border areas, develop growth strategies, train Chinese and Vietnamese workers, and improve their organizational and management capacities. Business development services are a critical element in supporting SME development in border areas, which will be strengthened via this project.

69. **Limitations in Cross-border Financial Transactions and Investments**. Cash remains the dominant means of concluding cross-border transactions, relying on families as the major source of borrowing capital. This limits financial transactions and investments. This project aims to attract private businesses into border areas through provisions of efficient and cost effective cross-border financial services such as access to credit and services in cross-border payments and settlements.

70. **Difficulties in Adopting New Technologies**. New technologies such as e-commerce are important for accessing markets at and beyond borders. Guangxi still faces constraints in cross-border e-commerce development. These constraints include (i) high start-up costs and technological complexities discouraging investments in e-commerce; (ii) fragmented market without market leaders to provide demonstration effect; (iii) lack of dedicated e-commerce parks to provide one-stop services covering information and communications technology, payment and settlement, logistics and customs clearance; and (iv) weak capacity in terms of lack of trained professionals and actual practitioners with sufficient knowledge of international best practices. This project will improve the e-commerce platforms for cross-border trade, transaction settlement, customs clearance and other items.

71. **Poor Connectivity in Linking Key Economic Points of Interest across the Border**. While physical connectivity between Guangxi and Viet Nam has been generally improved in recent years, there are still gaps in cross-border transport links. These include (i) the lack of expressways or high-grade trunk roads linking the economic enters in Guangxi and Viet Nam; (ii) low density and poor conditions of feeder roads in the border area, particularly those linking the border economic zones on both sides of the border; and (iii) insufficient number of border bridges with low through-put capacity. This project will improve the transport network and road conditions in the border area, and through-put capacities at selected border control points.

C. Subproject 1: Construction of Fangchenggang Training Center for Chinese and Vietnamese workers and SMEs

72. This subproject is located in the existing Jiangshan Peninsula Science and Technology Park in Gangkou District in Fangchenggang. Five buildings will be constructed using ADB loan on the existing campus of the Fangchenggang Poly Tech Vocational School. These consist of a training building with classrooms for training Chinese and Vietnamese workers on trade, logistics, e-commerce and hotel and tourism services; two student dormitories; a comprehensive information building with library and offices for teachers and administration; and a sports management office (Table 12). Total floor area is 35,077.80 m^2, taking up 6,844.77 m^2 land area. Figure 2 shows the layout of the campus and the locations of the subproject buildings on the campus.

73. Building design will include features to accommodate those with disabilities in accordance with GB50763-2012 *Codes for Accessibility Design*《无障碍设计规范》as well as energy saving features. Water will be supplied by the municipal water supply network. Water heating for the student dormitories will use solar energy and air source heat pump. The drainage system will separate rain water and wastewater. Rainwater will be collected by the rain water collection pipelines and discharged into nearby drainage ditches. Septic tanks will be installed at each building to treat domestic wastewater generated by the teachers and students in each building, then conveyed to an underground package wastewater treatment plant on campus with a treatment capacity of 2,500 m^3/d for treatment to Class 1 effluent standard in *Integrated Wastewater Discharge Standard* (GB 8978-1996) before discharging via the municipal sewer network to the sea at Xiwan. Raw materials would consist of common building materials that will be sourced locally.

Table 12: Description of Buildings for Subproject 1

Building Name	No. Storey	Floor Area (m^2)	Land Take (m^2)
Training building #3	5	6,973.60	1,399.50
Student dormitory #3	6	7,327.80	1,239.50
Student dormitory #4	6	7,327.80	1,239.50
Comprehensive information building	6 + 1 underground	11,658.60	2,576.27
Sports management and auxiliary office	4	1,790.00	390.00
	Total:	**35,077.80**	**6,844.77**

Source: FSR

Figure 2: Locations of Subproject Buildings on the Fangchenggang Poly Tech Vocational School Campus

Source: FSR

D. Subproject 2: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone

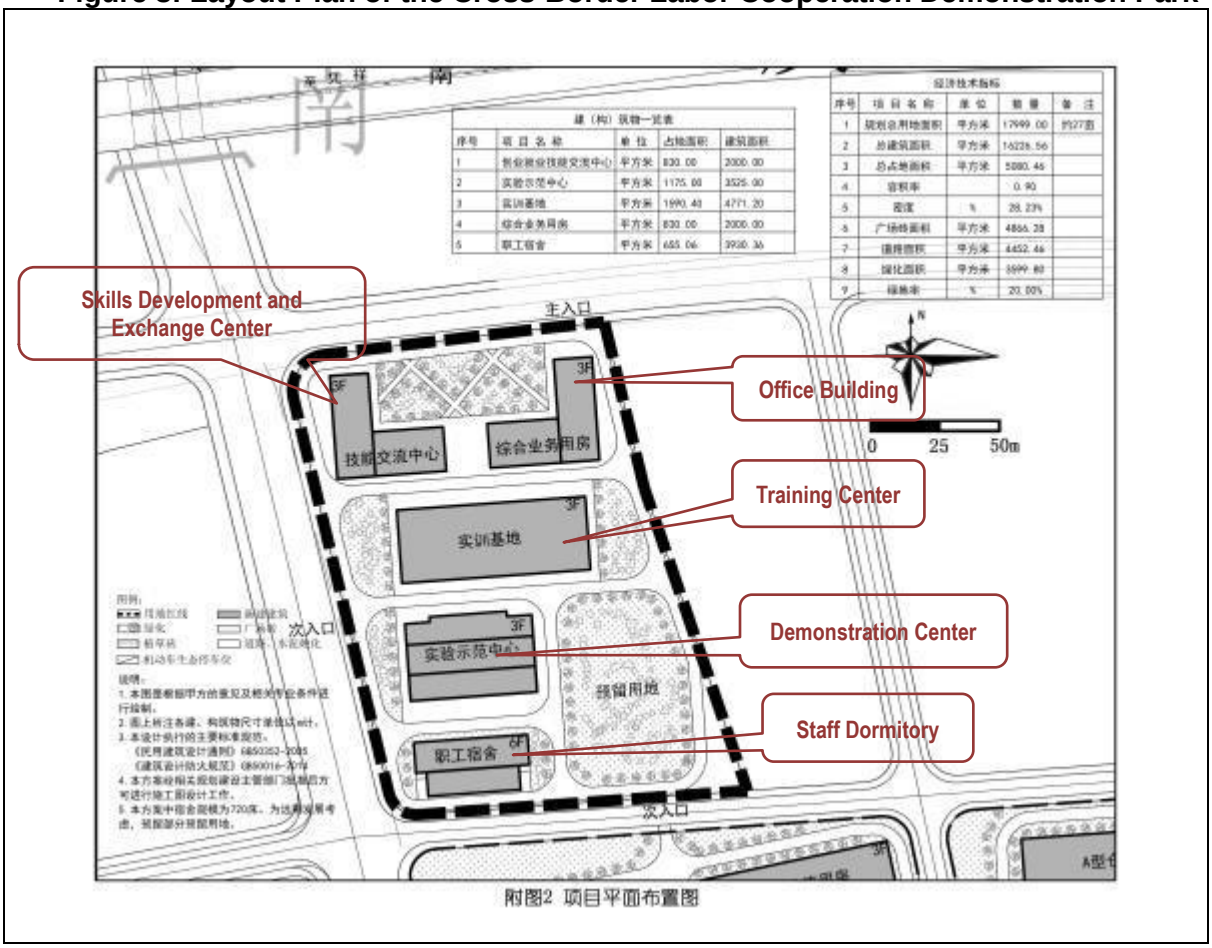
74. This subproject is located in the existing Youyiguan Industrial Park within the Pingxiang

Border Economic Zone, in Pingxiang City which is under the administration of Chongzuo. Total land take for the park is 17,999 m^2 (1.8 ha), within which five buildings with total floor area of 16,226.56 m^2 will be constructed on land areas of 5,058.46 m^2 as shown in Table 13. Construction of these buildings including fitting out is estimated to take approximately 22 months. The demonstration park will have approximately 50 staff and 2,000 students. Training and skills development and exchange will involve finishing processes on small household electrical appliances, redwood (imported legally) furniture and different kinds of nuts. Figure 3 shows the layout of the demonstration park.

Table 13: Description of Buildings for Subproject 2

Building Name	Land Take (m^2)	Floor Area (m^2)	No. of Storey	Building Structure
Demonstration center (for product exhibition)	1,175.00	3,525.00	3	Steel
Training center	1,590.40	4,771.20	3	Steel
Business offices	830.00	2,000.00	3	Brick & concrete
Skills development and exchange center	830.00	2,000.00	3	Brick & concrete
Staff dormitory	655.06	3,930.36	6	Brick & concrete
Total:	**5,080.46**	**16,226.56**		

Figure 3: Layout Plan of the Cross-Border Labor Cooperation Demonstration Park



Source: EIT

75. Building design will include features to accommodate those with disabilities in accordance with GB50763-2012 *Codes for Accessibility Design*《无障碍设计规范》as well as energy saving features. Water usage has been estimated to be 175.4 m^3/d (maximum), to be supplied through the Xiashi Town municipal water supply network. The drainage system for the demonstration park will separate rain water and wastewater. Rainwater will be collected by the rain water collection pipelines in the Youyiguan Industrial Park and discharged into nearby drainage ditches. Domestic wastewater from the staff, students and the canteen has been estimated to total approximately 272 m^3/d, and will go through oil-water separation and septic tanks prior to discharge into the municipal sewer for treatment at the Xiashi Town Wastewater Treatment Plant commissioned in August 2016 with a design capacity of 500 m^3/d. Raw materials would consist of common building materials that will be sourced locally.

E. Subproject 6: Expansion of Pingxiang Border Trade Service Center

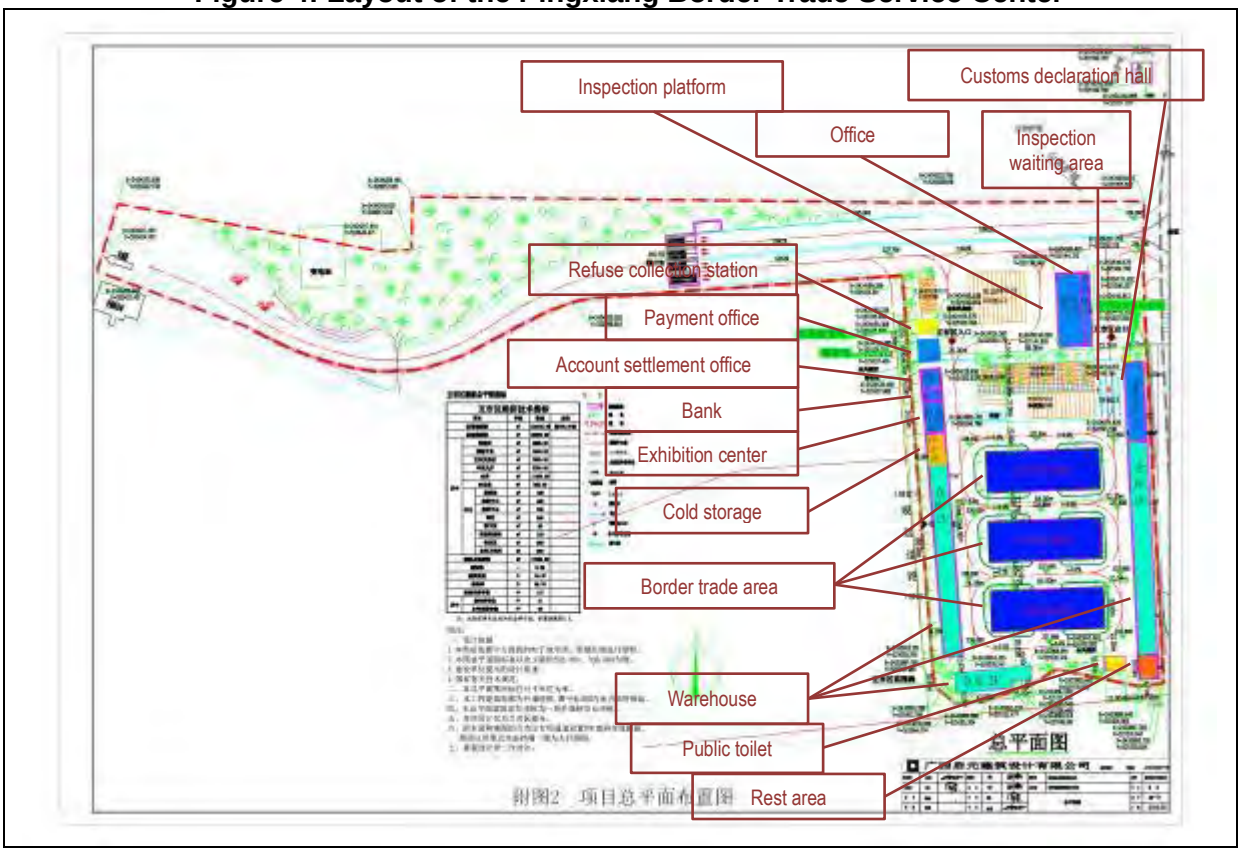
76. This subproject is located to the immediate west of the existing Pingxiang Border Trade Logistics Center in Youyi Town in Pingxiang City, which is under the administration of Chongzuo. Total land take for the center is 110,443 m^2 (11 ha). It consists of buildings and border trade areas as shown in Table 14 with a total floor area 25,580 m^2 taking up 17,090 m^2 of land. Construction is estimated to take approximately seven months. Figure 4 shows the layout of the border trade service center.

Table 14: Description of Buildings and Facilities for Subproject 6

Name of Building / Facility	Floor Area (m^2)	No. Building	No. of Storey
Inspection platform	1,045.00	1	1
Border trade area	7,560.00	3	1
Custom declaration hall	2,700.00	1	3
Warehouse (including cold storage)	11,400.00	3	2
Office	330.00	1	1
Payment office	165.00	1	1
Account settlement center	480.00	1	2
Exhibition center	720.00	1	2
Bank	240.00	1	2
Security office	50.00	1	1
Refuse collection station	150.00	1	1
Resting area	540.00	1	2
Public toilet	200.00	1	1
Total:	**25,880.00**		
Inspection waiting area	3,895.00	none	not applicable

Source: EIT

Figure 4: Layout of the Pingxiang Border Trade Service Center



Source: EIT

77. Building design will include energy saving features. Water usage has been estimated to be 41.45 m^3/d (maximum), to be supplied by the existing Jinjishan Water Supply Station. The drainage system for the demonstration park will separate rain water and wastewater. Rainwater will be collected by the rain water collection pipelines and discharged into nearby drainage ditches. Domestic wastewater has been estimated to total approximately 114.21 m^3/d and will be discharged to the wastewater treatment station at the neighboring Pingxiang Border Trade Logistics Center for treatment. Upon completion of the Kafeng Wastewater Treatment Plant, domestic wastewater from the border trade service center will be conveyed to this WWTP for treatment instead. The Kafeng WWTP has a design capacity of 1,000 m^3/d, with 500 m^3/d to be built in phase 1. It is in the domestic environmental impact assessment stage and construction for phase 1 has been estimated to take approximately one year. No date has been set for its commissioning. Raw materials would consist of common building materials that will be sourced locally.

78. The 11,400 m^2 warehouse for storage of mainly dry fruit products includes 660 m^3 for cold storage, using liquid ammonia as the coolant. The maximum quantity of liquid ammonia to be stored on site would not exceed 5 tons at any given time.

F. Capacity Development and Institutional Strengthening

79. Two subprojects will contribute to capacity development and institutional strengthening. Subproject 9 will consist of a demand analysis of SMEs in border areas for business

development services, capacity assessment of SME service centers and formulation of strategy and action plan for improved capacity and institutional arrangement in business development services. Subproject 10 will provide consulting services on institutional support, capacity building and advisory assistance for project implementation and preparation of future tranches. These subprojects have no adverse environmental impacts.

G. Climate Change Adaptation Considerations

80. Climate risk and vulnerability assessment for the three subprojects has been conducted[13] (Appendix 2). The subproject areas are characterized by hot summers, warm winter and plenty of rainfall, as well as complex geology. Heavy rainfall induced flood is a major natural hazard. Complex geology has resulted in geological hazards such as landslide.

81. Climate projections for the project area (using Qinzhou data to represent the Fangchenggang area and Longzhou data to represent the Pingxiang area) in 2050 and 2100 were developed using greenhouse gas (GHG) Representative Concentration Pathways from the Intergovernmental Panel on Climate Change Fifth Assessment Report (AR5), with low, mid and high scenarios for each time horizon representing low, mid and high climate sensitivity. Results show that potential climate change impacts include heavy rainfall, sea level rise and heatwaves.

82. **Extreme Rainfall**. Annual maximum daily rainfall in the Fanchenggang area was projected to increase on average by approximately 6% in 2050 and 12% in 2100 under the mid-scenario, and 12% in 2050 and 28% in 2100 under the high scenario. Annual maximum daily rainfall in the Pingxiang area was projected to increase on average by approximately 7% in 2050 and 14% in 2100 under the mid-scenario, and 14% in 2050 and 32% in 2100 under the high scenario.

83. **Sea Level Rise**. The sea level rise rate of Beibu Gulf off Fangchenggang is 1.16 cm per 1 cm global rise, which is lower than the coastal area of the neighboring Guangdong Province, perhaps due to protection from the surrounding land mass particularly the Hainan Island and Leizhou Peninsula to the south. Predictions show substantial rise of sea level in Beibu Gulf by approximately 25 cm by 2050 and 64 cm by 2100. The Fangchenggang Poly Tech Vocational School is located on high ground and would not be affected by sea level rise. Pingxiang is inland and would not be affected by sea level rise.

84. **Heatwave**. Heatwave hazard was projected to increase significantly due to climate change. Heatwave is generally defined as a consecutive days of temperature above a given threshold. Heatwave is still rare in the Fangchenggang area (on average less than 2 times per 100 years) and the Pingxiang area (on average 5 times per 100 years). Based on mid-scenario projections, heatwave frequency by 2050 is likely to increase by almost 9 times over the baseline for the Fangchenggang area and by 8 times for the inland Pingxiang area. It would likely become an annual event by 2100 for both cities. Heatwave duration was also predicted to increase, from 7 days to 8 days by 2050 and to 15 days by 2100 for the Fangchenggang area, and from 8 to 15 days by 2050 and to 17 days by 2100 for the Pingxiang area.

[13] Ye, W. 2016. Climate change impact assessment on Guangxi Regional Cooperation and Integration Promotion Investment Program, the People's Republic of China. Technical assistance consultant's report for ADB.

85. **Adaptation Options**. Hard and soft options have been recommended for climate change adaptation. Hard options are engineering measures for adapting to extreme rainfall and heatwaves. To prevent urban flooding during extreme rainfall events, sufficient drainage capacity is critical. For subproject 1, an 8% increase from the current drainage standard is recommended for adoption in the detailed drainage system design for the Fangchenggang Poly Tech Vocational School campus. For the two subprojects in Pingxiang, a 10% increase from the national standard should be used in the detailed drainage system design. It is also recommended that a higher design standard should be adopted for the slope stabilisation design for all slopes within the subproject sites. For heatwave adaptation, necessary facilities for air conditioning such as sufficient power supply, air conditioning facility space, etc, should be in place or allowed for in design for future installation.

86. Soft measures include ecological solutions and management options. These include good vegetation cover to prevent soil erosion and landslide hazard. More green space and good vegetation cover is also an effective option to reduce heatwave risk to human health. Heatwave risk can also be managed through awareness raising and preparedness when heatwave strikes.

H. Associated Facilities

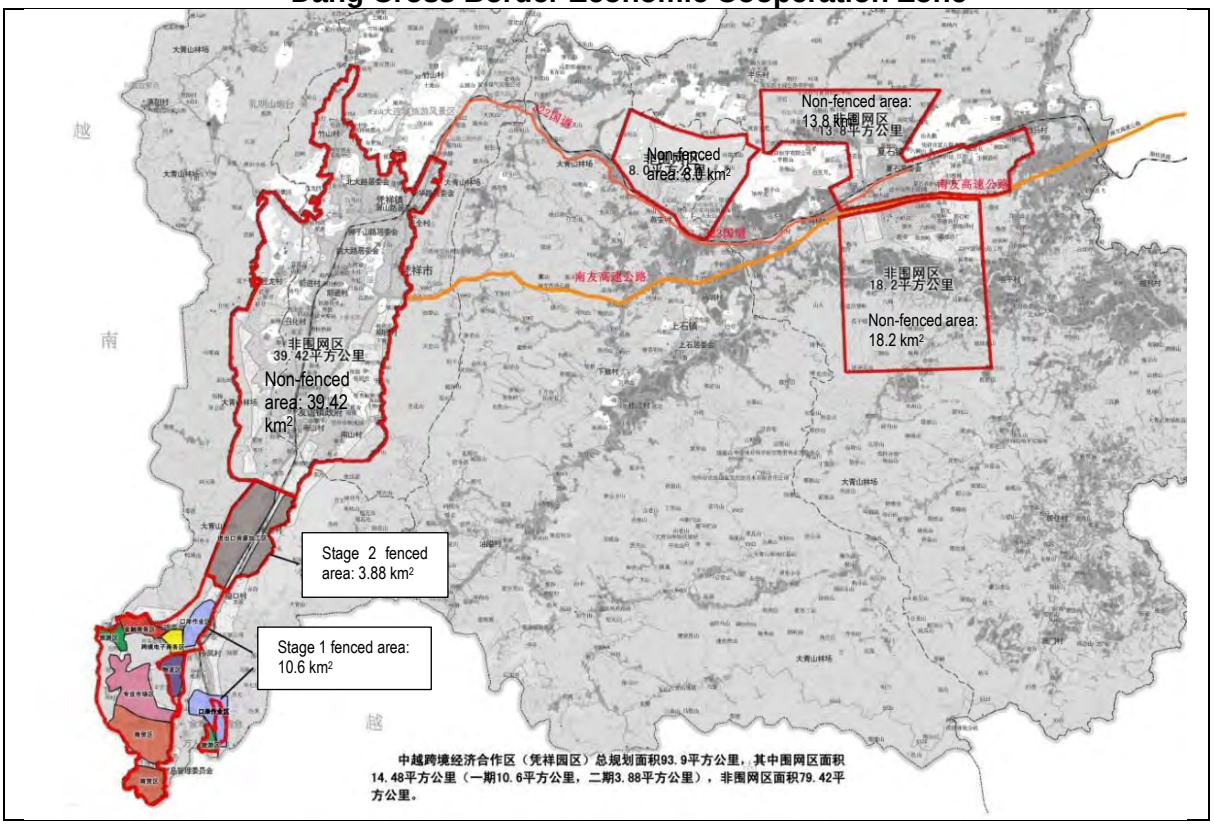
87. Based on SPS (2009) definition of associated facilities, the three tranche 1 subprojects do not have facilities that are not funded by the project but (i) whose viability and existence depend exclusively on the project and (ii) whose goods and services are essential for successful operation of the project.

IV. DESCRIPTION OF THE ENVIRONMENT

88. The description of the pre-project environment (biophysical and socio-economic) establishes (i) the environmental setting within which the project will be implemented, and therefore needs to be designed to suit, and (ii) the environmental values which will be changed (either negatively or positively) by the project. Both these roles are encompassed by the concept of the “baseline” environment.

89. Subprojects 2 and 6 are both located on the Pingxiang side of the **PRC - Viet Nam Pingxiang – Dong Dang Cross Border Economic Cooperation Zone**. The *Master Development Plan (2015-2030)* for this zone in Pingxiang dated May 2015 indicates that it has a total area of 93.9 km^2 consisting of fenced areas of 14.48 km^2 and non-fenced areas of 79.42 km^2 (Figure 5).

Figure 5: Planning Areas of the Pingxiang Side of the PRC – Viet Nam Pingxiang – Dong Dang Cross Border Economic Cooperation Zone

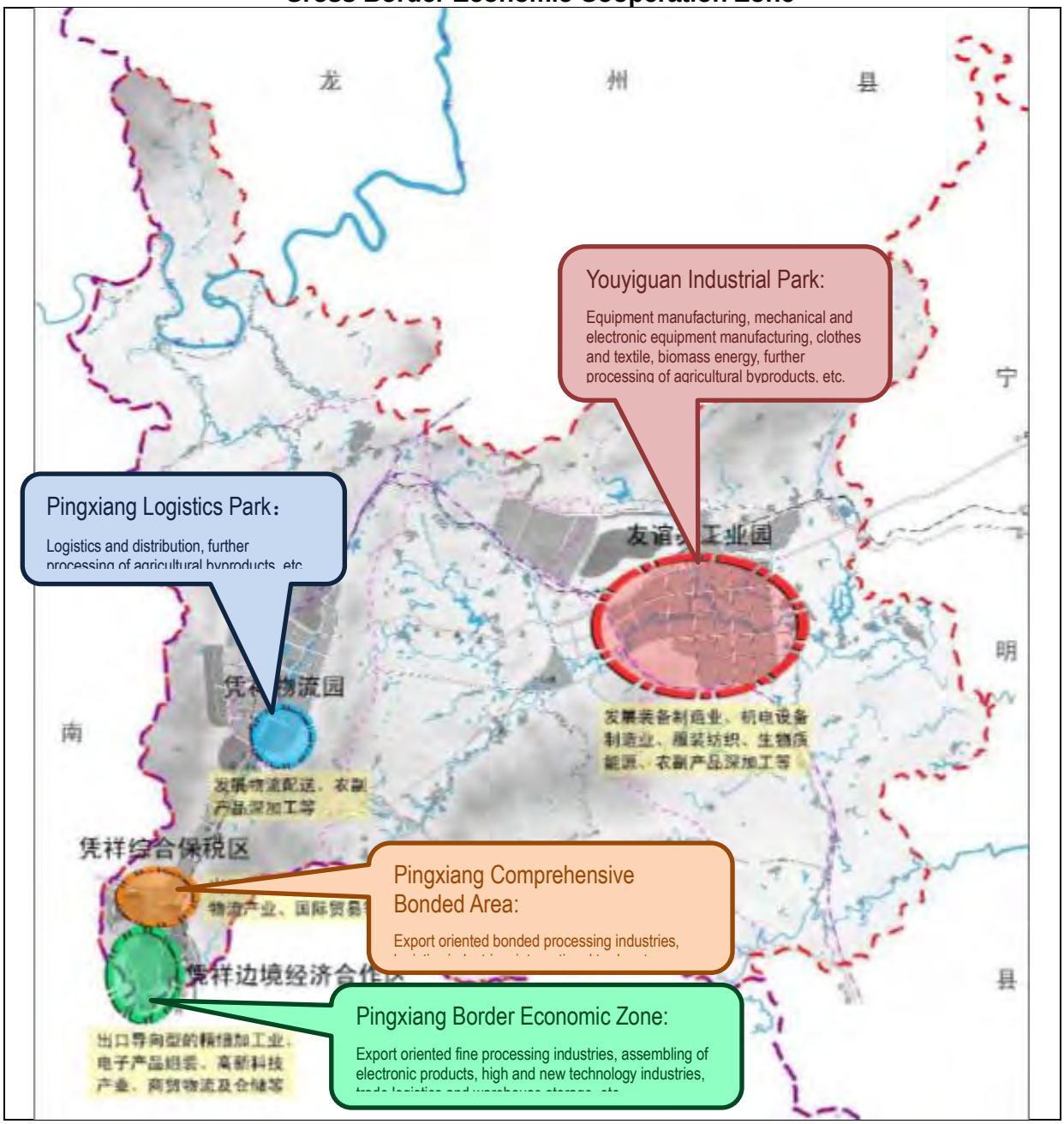


Source: Master Development Plan of the China - Vietnam Pingxiang – Dong Dang Cross Border Economic Cooperation Zone (2015-2030)

90. Figure 6 shows the industrial subzones and their typical industries within the PRC - Viet Nam Pingxiang – Dong Dang Cross Border Economic Cooperation Zone in Pingxiang. These subzones include the Pingxiang Comprehensive Bonded Area and the Pingxiang Border Economic Zone (where subproject 6 is located) within the fenced areas, and the Pingxiang Logistics Park and the Youyiguan Industrial Park (where subproject 2 is located) within the non-fenced areas.

91. The *Master Development Plan* describes the municipal infrastructure for the industrial zones. For the border areas including the logistics park, water would be supplied to the border area by the Ping'er River Water Treatment Plant (WTP) which extracts water from the Ping'er River. The plant would go through stage 1 expansion and stage 2 construction. Wastewater would be treated by the Puzhai Wastewater Treatment Plant (WWTP), the Kafeng WWTP and the Nonghuai WWTP. For the industrial areas further away from the border such as the Youyiguan Industrial Park, water supply would be from the new Shuangshi WTP. The Shuangshi WTP would also be connected to the Ping'er River WTP so that one could function as the backup water source for the other. Small existing WTPs such as the Daxiang WTP, Nanshan WTP Shangshi WTP and Xiashi WTP would be retained as backup treatment plants. Wastewater would be treated by the Xiashi WWTP and the Shangshi WWTP.

Figure 6: Industrial Layout in Pingxiang within the PRC - Viet Nam Pingxiang – Dong Dang Cross Border Economic Cooperation Zone



Source: Master Development Plan of the PRC – Viet Nam Pingxiang – Dong Dang Cross Border Economic Cooperation Zone (2015-2030)

A. Existing Setting of the Project Sites

92. **Subproject 1: Fangchenggang Training Centre for Chinese and Vietnamese Workers and SMEs.** The proposed subproject site (E 108.32°, N 21.63°) is located on the campus of the Fangchenggang Poly Tech Vocational School in Jiangshan Peninsula Scientific and Technology Park in Shamuwan Village, Jiangshan Township, Fangcheng Town of Gangkou

District in the prefecture-level city of Fangchenggang. The site is surrounded by low hills to the east and south, and is adjacent to the Shamuwan Village Shiping Group to its east, with a population of about 150 persons. There is a shrimp pond about 500 m from the eastern boundary across the hills with ongoing shrimp culture. The Guangxi School of Finance and Economics Fangchenggang Campus is located about 150 m to the west, with about 2,000 teaching and administrative staff and students at present and a planned expansion to 5,000 persons in the future. The site is bordered to the north by the Port - Dongxing Class 1 Highway, with hilly terrain on the other side of the highway. Part of the Fangchenggang Poly Tech Vocational School campus is under construction already, this is not funded by ADB. Figure 7 shows the surrounding environmental setting of the Fangchenggang Poly Tech Vocational School.

Figure 7: Surrounding Environmental Setting of the Fangchenggang Poly Tech Vocational School

School campus under construction

Port - Dongxing Class 1 Highway to the north

Low hills to the south

Guangxi School of Finance and Economics Fangchenggang Campus to the west

Campus slope protection work to the east

Shamuwan Village Shiping Group and shrimp pond behind hills to the east

Source: PPTA site survey

93. **Subproject 2: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone**. The subproject site (E 106.91°, N 22.12°) is located in Youyiguan Industrial Park in Pingxiang City and covers an area of 1.8 ha (or 17,999 m^2). G7211 Nanning-Youyiguan Highway is about 60 m from its northern boundary. The site is presently covered with shrubbery vegetation and irrigation storage ponds. It is bordered by farmland to the north, east and south; and by X462 county road to the west. On the other side of the county road is the planned warehousing and logistics base of the industrial park. Figure 8 shows the surrounding environmental setting of the subproject site.

Figure 8: Surrounding Environmental Setting of the Cross-border Labor Cooperation Demonstration Park in the Pingxiang Border Economic Zone

The proposed subproject site

North of the proposed subproject site

South of the proposed subproject site

Southwest of the proposed subproject site

West of the proposed subproject site

X462 county road in its west

Source: EIT and PPTA site survey

94. **Subproject 6: Pingxiang Border Trade Service Center.** The subproject (E 106.71°, N 22.00°) is located to the north of Kafeng Village, Youyi Town, Pingxiang City. The subproject site's current land use status is vacant grassland. The Pingxiang Border Trade Logistics Center (under construction) is located to its east, and Kafeng Village and Busha Village are about 130 m and 210 m respectively from the proposed site boundary. The subproject site is relatively flat. There is no ecological or natural landscape surrounding the proposed subproject site. **Figures 9** and **10** show the surrounding setting of the Pingxiang Border Trade Service Center.

Figure 9: Map showing Location of the Pingxiang Border Trade Service Center and Vicinity

Note:● environmental sensitive receptor
Source: EIT

Figure 10: Surrounding Environmental Setting of the Pingxiang Border Trade Service Center

The proposed subproject site

Busha Village 210 m to its southwest


Kafeng Village 130 m to its south-south-east

Source: EIT and PPTA site survey

B. Existing Sensitive Receptors

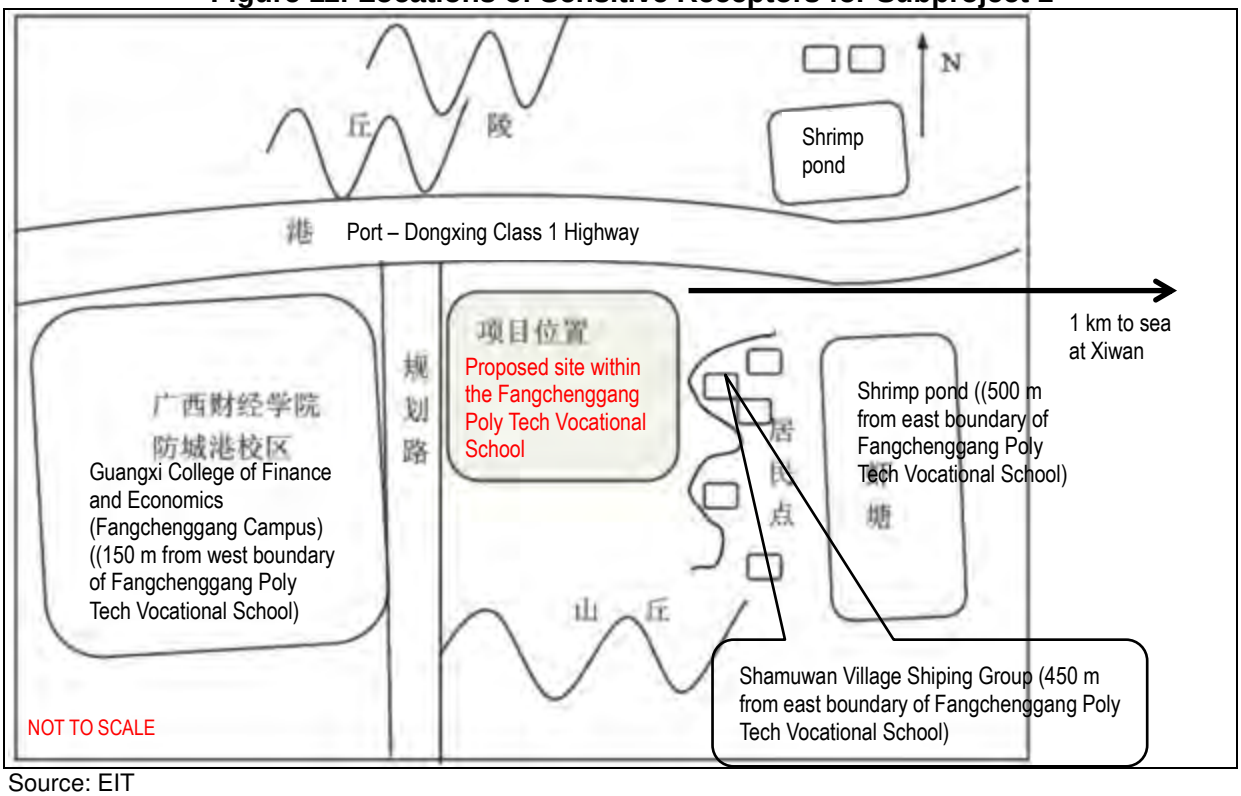
95. Based on field surveys, the subproject EITs identified various types of sensitive receptors/ protection targets that currently exist within the subproject areas of influence. Tables 15, 16 and 17 list these sensitive receptors for subprojects 1, 2 and 6 respectively. Locations of these sensitive receptors for the three subprojects are illustrated in Figures 11, 12 and 13.

Table 15: Existing Sensitive Receptors for Subproject 1: Fangchenggang Training Centre for Chinese and Vietnamese Workers and SMEs

No.	Name of Sensitive Receptor	Feature	Direction	Distance	No. of Persons	Applicable Environmental Standard
1	Shiping Group, Shamuwan Village,	Residential	East	Across hills (450 m)	About 150	i. **Air** quality shall meet **Class 1** standard in *Ambient Air Quality Standards* (GB 3095-2012). ii. **Acoustic** environment shall meet **Category 1** standard in *Environmental Quality Standard for Noise* (GB 3096-2008); and the sensitive receptors within 50±5m away from trunk roads shall meet **Category 4a** standard in *Environmental Quality Standard for Noise* (GB 3096-2008) iii. WBG EHS standard/WHO ambient **air** quality guidelines and **noise** standards
2	Guangxi School Of Finance and Economics (Fangchenggang Campus)	School	West	150 m	About 2,000	
3	A shrimp pond connected with the sea	Fishery	East	Across hills (500 m)	--	iv. **Marine water** quality shall meet **Category 2** standard in *Sea Water Quality Standard* (GB 3097-1997).
4	Sea area at Xiwan	Marine	East	1 km	--	v. **Marine water** quality shall meet **Category 4** standard in *Sea Water Quality Standard* (GB 3097-1997).

Source: EIT and PPTA site survey

Figure 11: Locations of Sensitive Receptors for Subproject 1



Source: EIT

Table 16: Existing Sensitive Receptors for Subproject 2: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone

No.	Name of Sensitive Receptor	Feature	Direction	Distance	No. of Persons	Applicable Environmental Standards
1	Bannan Village	Residential	East	180 m	About 35 persons (8 households)	i. Air quality shall meet **Class 2** standard in *Ambient Air Quality Standards* (GB 3095-2012). ii. Acoustic environment shall meet **Category 2** standard in *Environmental Quality Standard for Noise* (GB 3096-2008); and the sensitive receptors within 35±5m away from trunk roads shall meet **Category 4a** standard in *Environmental Quality Standard for Noise* (GB 3096-2008) iii. WBG EHS standard/ WHO ambient **air** quality guidelines and **noise** standards
2	Banling River	2.0 m^3/s average flow rate	South	1.7 km	--	iv. **Category 3** standard in *Environmental Quality Standards for Surface Water* (GB 3838-2002)
Note: Domestic wastewater generated during operation will be discharged into the Xiashi Town Wastewater Treatment Plant (commissioning in August 2016) via municipal sewer. There will be no direct discharge from the subproject into the Banling River.						

Source: EIT and PPTA site survey (on Banling River)

Figure 12: Locations of Sensitive Receptors for Subproject 2

Source: EIT and PPTA consultant (on Banling River)

Table 17: Existing Sensitive Receptors for Subproject 6: Expansion of Pingxiang Border Trade Service Center

No.	Name of sensitive receptor	Direction and Closest Distance	Conditions of drinking water	Basic information of sensitive receptors	Applicable environmental standards
1	Puzhai Village	890 m to northwest	Tap water	about 600 persons	i. **Class 2** standard in *Ambient Air Quality Standards* (GB 3095-2012); ii. **Category 2** standard in *Environmental Quality Standard for Noise* (GB 3096-2008) iii. WBG EHS standard/ WHO ambient air
2	Guanjing Village	650 m to northeast		about 300 persons	
3	Guan'ai Village	430 m to northeast		about 350 persons	

No.	Name of sensitive receptor	Direction and Closest Distance	Conditions of drinking water	Basic information of sensitive receptors	Applicable environmental standards
4	Banbu Village	500 m to northeast		about 300 persons	quality guidelines and noise standards.
5	Kafang Village	300 m to south		about 80 persons	
6	Guqie Village	380 m to west		about 188 persons	
7	**Kafeng Village**	130 m to southeast		about 500 persons	
8	**Busha Village**	210 m to southwest		about 120 persons	
9	A nameless gully	100 m to south	/	Flowing from east to southwest	iv. **Category 3** standard in *Environmental Quality Standards for Surface Water* (GB 3838-2002)

Source: EIT

Figure 13: Locations of Sensitive Receptors for Subproject 6

Source: EIT

96. **Air Quality and Noise**. Existing air quality and noise sensitive receptors within the EIT assessment areas of 1 km[14] from the boundaries of the proposed three subproject sites are presented above in Tables 13, 14 and 15, respectively. In summary, there are 11 existing air quality and noise sensitive receptors for the proposed three subproject sites, including one school. Most of the sensitive receptors are two- to three-storey brick buildings for residential use. There are a few mid-rise buildings with six storeys or more on the Guangxi School of

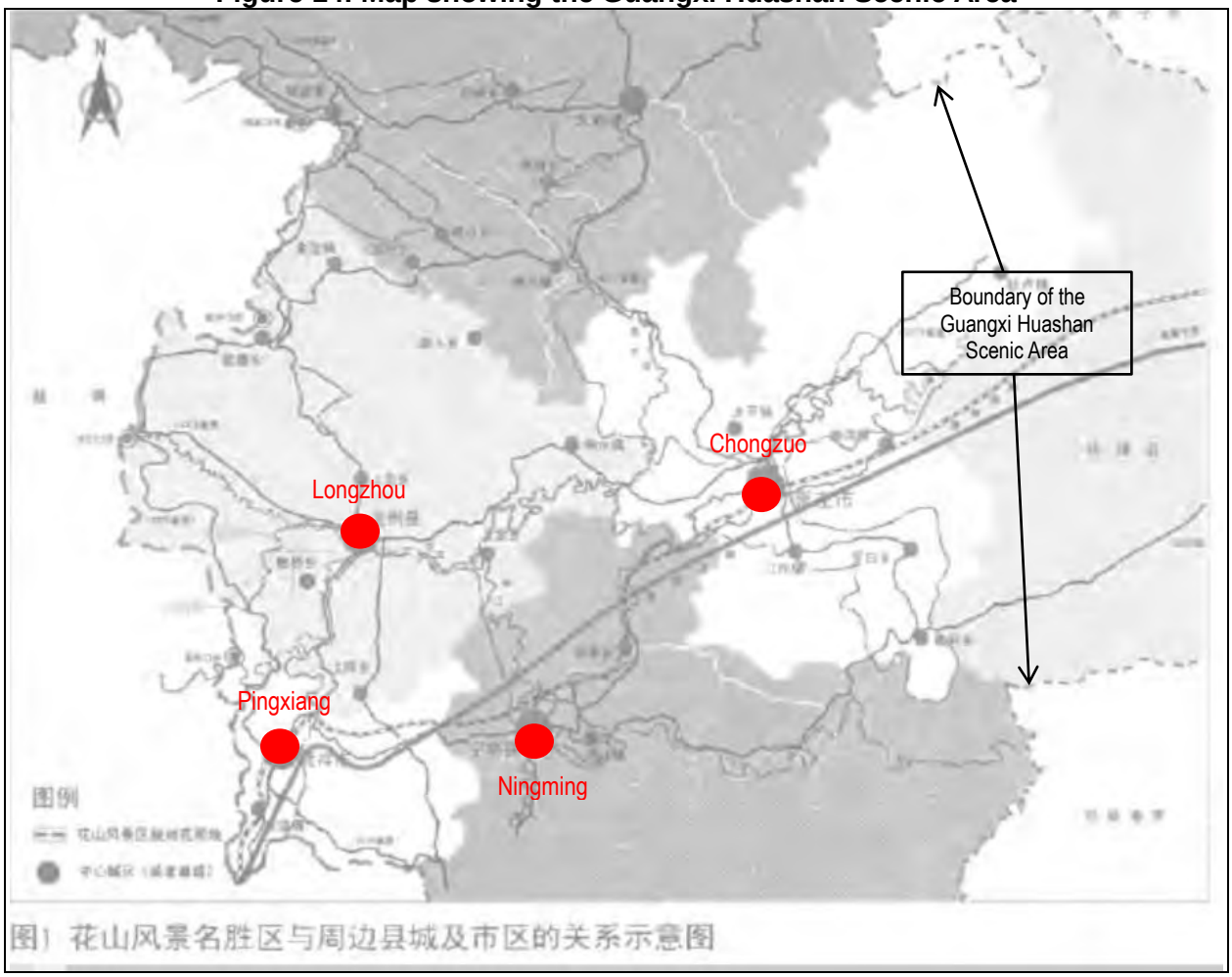
[14] Usually only 200m, so the subproject EITs are more conservative.

Finance and Economics (Fangchenggang Campus). The 11 sensitive receptors are estimated to consist of an estimated population of approximately 4,600. The Guangxi School of Finance and Economics (Fangchenggang Campus) has dormitories for teachers and students. The noise sensitive receptors are grouped under noise functional area categories 1, 2 and 4a.

97. **Water Quality**. Water quality sensitive receptors in the vicinity of the three proposed subproject sites include one river (Banling River, about 1.7 km away), a nameless ditch (about 100m away), a shrimp culture pond and marine water in Beibu Gulf (over hills and at distances of 500 m and 1 km away respectively).

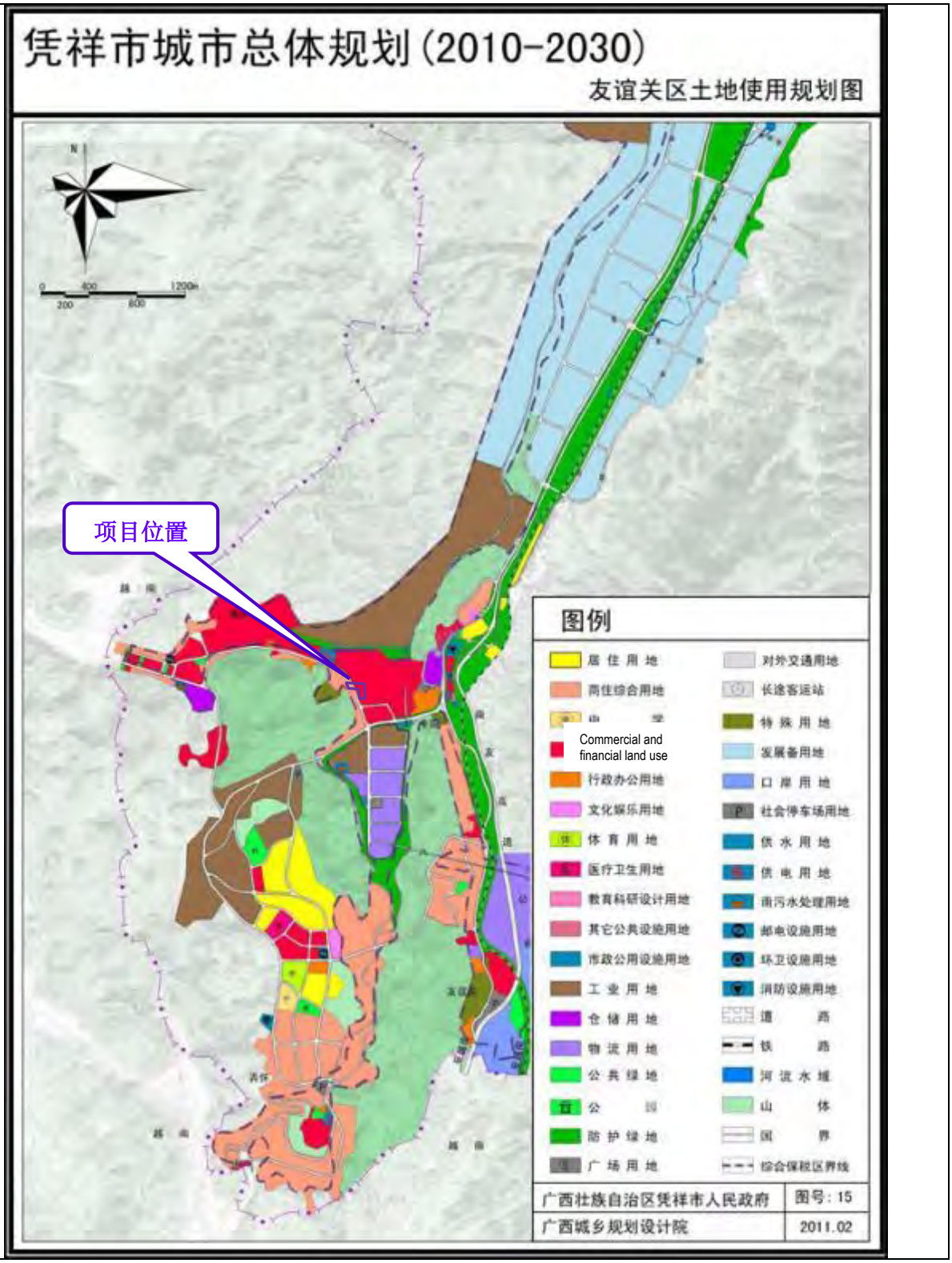
98. **Relationship between Subproject 6: Pingxiang Border Trade Service Center Subproject and Guangxi Huashan Scenic Area**. Guangxi Huashan Scenic Area is one of the key national scenic areas approved and published by the State Council in 1988. It includes partial areas of Jiangzhou District, Ningming County, Longzhou County, Daxin County and Pingxiang City in the prefecture-level city of Chongzuo (Figure 14**)**. It covers 23 townships and 153 administrative villages, with a total area of 3,001 km^2. According to an earlier master plan of Guangxi Huashan Scenic Area, the proposed Pingxiang Border Trade Service Center subproject site is located inside the scenic area. However, according to the latest *Master Plan of Huashan Scenic Area* (October 1993), land use within some scenic areas in Jiangzhou District, Ningming County, Longzhou County and Pingxiang City were designated as economic and social activity centers. In consideration of the absence of unique landscape and scenic resources in these areas versus local economic development, it is not suitable to include the whole district and three counties into the scenic area. Thus the population and urban land of this one district and three counties are excluded from the scenic area protection although they are geographically inside the scenic area boundary. This subproject site is located within the zone categorized for commercial and financial land use (Figure 15**)** in the *Land Use Plan for Youyiguan District, Urban Master Plan of Pingxiang City (2010~2030).* The land for the Pingxiang Border Trade Service Center subproject therefore does not belong in the scenic area.

Figure 14: Map showing the Guangxi Huashan Scenic Area



Source: Urban Boundary Research Of The Towns Surrounded By Scenic Area：Huashan Case / Wei Pengtao., Planners, 2012, 28(z2)

Figure 15: Land Use Plan for Youyiguan District according to the Pingxiang City Urban Master Plan (2010-2030)



Sopurce: EIT

99. **Protected Area**. According to site surveys and the domestic EITs, no historical and cultural protection areas, nature reserves, scenic spot, drinking water source and other protection areas or species with international, national or provincial protection status have been identified within the subproject assessment areas of influence. No ecological sensitive receptors have been identified within the subproject areas of influence. The subproject sites are not located in critical or natural habitats.

C. Physical Setting

1. Overview of Guangxi

100. Guangxi is a mountainous region. The Nanling Mountain range is located near the northeast border, with the Yuecheng Mountain and Haiyang Mountain being its shorter branching ridges. Nearer to the center of the region are the Dayao Mountain and the Daming Mountain. In the north are the Duyao Mountain and the Fenghuang Mountain. Near the southeast border is the Yunkai Mountain. The highest point is Mount Mao'er located at the Yuecheng Mountain, at 2,141 m. Many river cut valleys run through the mountains. Most of these rivers form the tributary watershed of the West River. Guangxi has a short coastline on the Gulf of Tonkin. Important seaports include Beihai, Qinzhou and Fangchenggang. Guangxi has a subtropical climate. Summers are generally long and hot. Average annual temperature is 17 ^{o}C to 23 ^{o}C, while average annual precipitation is 1,250 to 1,750 mm. Guangxi has a rich and diverse ecosystem partly due to the subtropical climatic conditions and topography. Over 6,000 plant species and a variety of wild animals have been recorded.

2. Fangchenggang

101. **Geography and Terrain**. Fangchenggang is a prefecture-level city located in the southern region of the Guangxi Zhuang Autonomous Region (GZAR) between N 21°36′~22°22′ and E 107°28′~108°36′. Its administrative area totals 6,181 km^2, including 42 km^2 of built-up urban areas. It neighbors the prefecture cities of Qinzhou to the east, Chongzuo to the west and Nanning to the northeast. It borders with Viet Nam to southwest and the Beibu Gulf to the south.

102. Fangchenggang is a coastal city in southeastern PRC, with a coastline of 584 km, which is longer than the inland border line is 212 km. It has four national Category-1 Ports, namely, Fangchenggang, Dongxing, Jiangshan and Qicha.

103. The **landscape** is interwoven with mountains, plateaus and hills (78%), water surface (8%) and alluvial plains (14%). The north and south are primarily low-mountains and hills. The central part is dominated by mountains. The southeast is lined with coastal hills and mudflats. The Shiwanda Mountain runs east to west through the territory.

104. The Fangchenggang Gulf is surrounded by hills on three sides with Fangcheng River, Shatan River and Nalan River converging inside the gulf and then into Beibu gulf. The **terrain** of the city contain hills, residual hill, terrace and plain, which were formed by the erosion of rivers and typhoon. The main geomorphic unit is coastal hills.

105. **Seismicity**. According to the *China Seismic Ground Motion Parameters Zoning Map* (GB 18306-2001) Amendment 1, the seismic intensity in Fangchenggang is Grade 6. The PRC

classifies seismic intensity into 12 grades under the *China Seismic Intensity Table* (GB/T 17742-2008), from Class 1 to Class 12 based on the severity of "shaking" of the earth surface and the extent of potential impact. Class 6 is intermediate in severity with most people unable to stand still and furniture falling.

106. **Climate**. The subproject area is in subtropical zone at lower latitude, belonging to subtropical monsoon climate. As it is on the coast of Beibu Gulf, it is influenced by warm air mass from the sea all year round, which provides the place with sufficient sunlight and rainfall and pleasant climate.

107. **Temperature.** The multi-year annual average temperature is 22.3 ^{o}C with the highest temperature being 37.8 ^{o}C and the extreme lowest temperature being 0.9 ^{o}C. The temperature reaches the highest in July averaging 31.2 ^{o}C. January has the lowest temperature averaging 12.0 ^{o}C.

108. **Rainfall.** The multi-year annual average rainfall is 2,314.5 mm with the highest annual average rainfall being 3,111.9 mm and the highest daily rainfall being 244.1mm (Fangchenggang meteorological station on May 16, 1972). The lowest annual average rainfall is 1745.6 mm. The city is regarded as being located in high rainfall region in GZAR. Rainy season runs from May to September, accounting for 83% of the annual rainfall. Rainfall from October to March makes up only 6.4% of the annual rainfall. August usually has the highest monthly rainfall, reaching 528.7 mm. December usually has the lowest monthly rainfall averaging only 23.9 mm.

109. **Evaporation.** The multi-year annual average evaporation is 1,512.1 mm. The highest evaporation usually occurs in September averaging 159.9 mm. February has the lowest evaporation averaging 65.8 mm. Annual variation basically corresponds to temperature changes.

110. **Wind.** Located at the northwestern part of the Beibu gulf, Fangchenggang has vast sea area, which gives the place obvious monsoon climate. Southerly wind is dominant in the summer and northeasterly wind in the winter. The dominant wind direction is NNE with a frequency of 30.5%, and the sub-normal wind direction is SSW with a frequency of 8.4%. Strong wind usually comes from the east with maximum speed reaching 36 m/s; the sub-strong wind direction is NNE with a maximum speed of 27 m/s. The annual average wind speed is 3.1 m/s. Typhoon occurs one to three times a year, mostly in June to September with average wind force of 8 to 9 degrees. The force of gust wind could reach 11 to 12 degrees.

111. **Frost and Fog.** Fog mostly occurs in winter and spring with an average of 10.9 foggy days. The maximum foggy period is 23 days and the minimum is 8 days. Normally fog appears from the night to early morning which lasts for 2 to 3 hours and disperses when the sun rises. The annual frost-free period is more than 350 days.

112. **Relative Humidity.** The annual average relative humidity is 82%. Monthly variation of relative humidity is between 74-87%, with the highest at 87% in July to Augusts, and the lowest at 74% in November. The annual average number of sunlight hours is 1,561.

113. **Hydrology and Surface Water Quality**. There are more than ten rivers flowing through Fangchenggang, with a total length of more than 400 km and an average annual runoff of

more than 8 billion m^3. Five major rivers drain into the Xiwan bay: Lizitan, Liyujiang, Dawangjiang, Chongsha (small stream) and Shitan (small stream) which are used primarily for irrigation purposes. The largest river is Lizitan, with a length of 13 km, average width of 40 m and average depth of 2 m. The Liyujiang River has a length of 3 km, average width of 2.5 m and average depth of 1.5 m. The Dawangjiang River has a length of 5.2 km, average width of 3 m and average depth of 2 m. The water quality for most of the marine areas meets Category I of the PRC *Sea Water Quality Standard* (GB 3097-1997).

114. Fangchenggang has a mixed **tidal** regime with 6/8-day small tides every month, which is irregular semi-diurnal tide and the rest is regular semi-diurnal tide including spring tide and neap tide. When the diurnal tide is dominant, the average tide level is 3.82 m with the highest tidal level reaching 5.54 m. The maximum tidal range is 5.39 m with the average tidal range larger than 4.5 m. Flood tide lasts for 15 hours, and ebb tide lasts 9 hours, which is favorable for the erosion and deposition of channels. When the semi-diurnal tide is dominant, the tidal range is less than 1 m with the smallest range at 0.79 m.

115. **Overall Environmental Quality**. According to the ambient environmental monitoring data in 2015[15], the overall environmental quality in Fangchenggang Municipality was rated as excellent[16]. All the ambient air, water and acoustic environmental parameters and noise level met the national ambient environmental standards. Specifically, the air quality meets the requirements of Class 2 of the national ambient air quality standards, with the annual average concentration of total suspended particulate matter smaller than 10 µm (PM_{10}) being 0.05 mg/m^3 compared to the class 2 threshold of 0.07 mg/m^3, particulate matter smaller than 2.5 µm ($PM_{2.5}$) 0.031 mg/m^3 (vs.0.035 mg/m^3), nitrogen dioxide (NO_2) 0.01 mg/m^3 (vs. 0.04 mg/m^3), and sulphur dioxide (SO_2) at 0.01 mg/m^3 (vs. 0.06 mg/m^3). The WBG/WHO Ambient Air Quality Guidelines only have annual average EHS standards on NO_2 and PM10 as well as $PM_{2.5}$. The yearly average NO_2 and PM_{10} data complied with the AQG targets (SO_2 <0.020 mg/m^3, PM_{10} <0.050 mg/m^3). The annual average $PM_{2.5}$ complied with the WBG/WHO Interim target-1 (<0.035 mg/m^3). The average urban daytime noise level was 55.8 dB(A), slightly exceeded the WBG EHS noise standard (<55 dB(A)) but complied with GB 3096-2008(<60 dB(A)). In all of the monitored river/marine sections, the water quality met the applicable national surface water and sea water quality standards.

116. **Baseline Environment for Subproject 1: Construction of Fangchenggang Training Center for Chinese and Vietnamese Workers and SMEs**. The subproject site is located in Jiangshan Peninsula on the southeast coast of Fangchenggang. Jiangshan Peninsula has hilly terrain and is mainly composed of sedimentary sandy shale bank. The highest elevation is about 150 m. The topography slopes downwards from southwest to northeast. In the east are sandy beaches, intertidal mudflats and rocky shores. The geological condition on the subproject site and in the vicinity is considered stable and not known for debris flow and landslide.

117. The subproject area's **landform** is a denuded platform with low hills. The coastal region is cracked-terrain land with zigzag coastline and developed harbor, sand levee and sandy beach. Its altitude is between 20 m and 80 m. The topographic relief is not large and the

[15] Fangchenggang Annual Environmental Statement, 2015, http://www.fcgs.gov.cn/zxzx/tzgg/ggxx/201606/t20160607_24408.html

[16] In the PRC, environmental quality is generally classified into five levels: excellent, good, mildly polluted, moderately polluted and heavily polluted.

mountain slope is gentle. The lithology is mainly composed of sandstone, mudstone and argillaceous sandstone in Jurassic system. The surface layer is eluvium of weathering and denudation, covered by well-developed vegetation. The **geological formation** is relatively stable with no passing of Holocene active vault. No unfavorable geological conditions or disasters such as landslide, mudslide, ground fracturing. Collapsed and karst cave have been found in the vicinity of the site. The site is weak in its stability with big elevation difference. It is mainly composed of medium hard soil with big topographic relief.

118. The **surface water** on Jiangshan Peninsula mainly includes the Tanpeng ancient canal and three small reservoirs: Wansong Reservoir, Tanpeng Reservoir and Wantan Reservoir. The main drinking water sources are Wantan Reservoir and more than 100 small wells distributed on the peninsula. Wantan Reservoir has a catchment area of 6 km^2 and a storage capacity of about 6,000,000 m^3.

119. Table 18 summarizes the baseline environmental conditions surrounding the subproject site in Fangchenggang.

Table 18: Summary of Baseline Environment in the Vicinity of Subproject 1 site

Baseline Environment	Description
Ambient air quality and acoustic environmental quality	Its north side is in immediate vicinity of the Port-Dongxing Class 1 Highway. The air and acoustic environmental quality is modest due to dust and noise from nearby traffic.
Sea water quality	According to sea water quality monitoring results around Fangchenggang port by Fangchenggang Municipal Environment Monitoring Station in 2013, **Category 4** in *Sea Water Quality Standard* (GB3097-1997) was met.
Summary of existing environmental condition	1) The subproject site is in immediate vicinity of the Port-Dongxing Class 1 Highway. There is certain influence on the subproject area by noise, dust and automobile exhaust emitted by vehicles; 2) No sewage interception pipe network is in Jiangshan Peninsula, so that the residential domestic wastewater in the east of the subproject site is directly discharged into the sea, which exerts certain influence on sea water quality in near shore area; 3) The subproject site neighbors the Fangchenggang Campus of the Guangxi College of Finance and Economics. Some buildings on the campus are under construction; which has potential dust and noise impact on the subproject area.

Source: EIT using data in Fangchenggang EPB annual environmental monitoring reports.

3. Pingxiang

120. **Geography and Terrain.** Pingxiang, which is a county-level city under the administration of the prefecture level city of Chongzuo, is located in the southwestern region of GZAR. Its longitude is between E 106°41'~106°59' and its latitude is between N 21°57'N ～22°16'. The administrative area of the city covers 650 km^2, having a width of 35 km from east to west, and length of 55 km from north to south. The straight-line distance between the city center to the border with Viet Nam is only 3 km. The length of its border with the Lạng Sơn Province of Viet Nam is 97 km. The city is the largest and most convenient land access from the PRC to Southeast Asia.

121. Pingxiang topography is dominated by mountainous terrain, sloping from the west to the east. The highest mountain is Mount Daqing with altitude of 1,256 m. The city's urban area lies to the north of the central mountain zone with elevations between 300 m to 500 m and

the relative height difference with the valley bottom is from 100 meters to 300 meters. The southeastern mountain zone extends from the east of Mount Daqing and Xiaoqing to the low mountains and hilly area between Ningming and Pingxiang. With average heights but jagged peaks, the southeastern mountain zone has great and steep slopes, thick grasses, dense forest and rough roads. The northeastern plain includes Xiashi, Liuli, Shaoping and other flat, wide or scattered piedmont plains and low earth mounds.

122. **Geology.** Pingxiang is located at the intersection of north-southeast tectonic system and north-west knob structure. Its geological structure is complicated, with fold and fracture. The earth surface has intrusive rock. From west to east, the terrain is roughly divided into western mountain zone, central mountain zone, southeastern mountain zone, northeastern mountain zone and central peak cluster & basin hill zone.

123. **Seismicity**. According to the *China Seismic Ground Motion Parameters Zoning Map* (GB 18306-2001) Amendment 1, the seismic intensity class in Pingxiang is 6. The PRC classifies seismic intensity into 12 classes under the *China Seismic Intensity Table* (GB/T 17742-2008), from Class 1 to Class 12 based on the severity of "shaking" of the earth surface and the extent of potential impact. Class 6 is intermediate in severity with most people unable to stand still and furniture falling.

124. **Climate.** Pingxiang is located in a subtropical climatic zone, with a subtropical monsoon climate characterized by mild winter, hot summer and abundant rainfall throughout the year. The summer begins in mid-April and ends in mid-October, lasting more than 180 days. January is the coldest month of the year with average temperature of 11.4 ^{o}C to 13.5 ^{o}C. July is the warmest month with average temperature of 25.7 ^{o}C to 27.7 ^{o}C. The rainfall ranges from 1,062 mm to 1,772 mm per year, with maximum daily precipitation of 206.5 mm. There are 344 frost-free days annually, and the average annual sunshine is 1,614 hours. Wind direction in a year is dominated by easterly and southerly wind in the summer and northeasterly wind in the winter. The annual average wind speed is 5-17 m/s.

125. **Hydrology and Surface Water.** There are 39 rivers in Pingxiang, all belong to the Pearl River System. The largest river is Ping'er River, which derives from the Qiqiong River in Viet Nam, and flows into the PRC along the western side of the Pinggong Mountain, through the cities of Pingxiang and Longzhou into Lijiang. The section of Ping'er River in Pingxiang is about 19 km long. In the wet season, the river is 120 m wide and 9 m deep, with maximum flow rate of 51,050 m^3/s. In transitional season, the river is 100 m wide and 4.5 m deep, with average flow rate of 108 m^3/s. In the dry season, the river is 50 m wide and 2.5 m deep, with minimum flow rate of 4.3 m^3/s (recorded in May 1958).

126. **Baseline Environment for Subproject 2**: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone. The proposed subproject site is located within the Youyiguan Industrial Park, where Class 2 standard in *Ambient Air Quality Standards* (GB 3095-2012) applies. The air quality in Pingxiang is excellent. According to the Environmental Statement of Pingxiang City in 2015, the city's daily average concentration of SO_2 was 0.011mg/m^3, PM_{10} 0.044mg/m^3, and NO_2 0.019mg/m^3. Overall the air quality can meet Class 2 standard. The WBG WHO Ambient Air Quality Guidelines only have daily average EHS standards on SO_2 and PM10, and the SO_2 and PM_{10} data complied with the AQG targets (SO_2 <0.020mg/m^3, PM_{10} <0.050mg/m^3).

127. The proposed subproject site is located within the Youyiguan Industrial Park where

Category 3 **noise** standards in *Environmental Quality Standard for Noise* (GB 3096-2008) apply. Based on field survey, there is farmland to the site's north, east and south with no major noise source; and X462 county road traffic volume is low. The subproject site should meet Category 3 noise standards. Site-specific baseline monitoring has not been carried out as ambient noise levels are low.

128. The Banling River (1.7 km from the subproject site) flows from Kunquan Village in Viet Nam, and into the PRC near the No. 23 Sino-Vietnamese border marker. The PRC section of the river has a total length of 34 km, watershed area of 294 km^2, water surface area of 0.6 km^2, and average flow rate of 2 m^3/s. The designated function of Banling River is for agricultural irrigation and its **water quality** satisfies Category III standards in *Environmental Quality Standards for Surface Water* (GB 3838-2002) based on monitoring results conducted in February and March 2014 on COD, BOD_5 and NH_3-N for the *Environment Assessment Report on Centralized Drinking Water Sources of Pingxiang City* approved in 2014.

129. **Youyiguan Industrial Park.** The Youyiguan Industrial Park, also known as Xiashi Industrial Park, is located in Xiashi Town. It has a planned area of 16.2 km^2 to function as the processing base of China-ASEAN Free Trade Area focusing on auto parts, electronics, textile and garment, food, pharmaceutical, agricultural and agricultural products reprocessing industries. The park's water supply is provided by Xiashi town water supply station (present capacity 20,000 m^3/d, design capacity 65,000 m^3/d), with a comprehensive water supply network. Wastewater goes through pre-treatment by industries to meet Class 3 standards (for discharging into public sewer) in *Integrated Wastewater Discharge Standard* (GB 8978-1996) then conveyed to the Xiashi Town WWTP for treatment via public sewers. Eventually the plan is to build a WWTP in the southern part of the park, with treatment capacity of 35,000 m^3/d. A planning EIA for the industrial park was prepared by the Guangxi Zhuang Autonomous Region Environmental Protection Science Research Institute and approved on June 13, 2008.

130. **Baseline Environment for Subproject 6: Expansion of Pingxiang Border Trade Service Center**. This proposed subproject site is located in Kafeng Village, Youyi Town next to the Pingxiang Border Trade & Logistics Center. The *Evaluation Report on Geologic Hazard Risk for Goods & Logistics Center of Pingxiang Border Trade Service*, describes the **geology** of the area to be quaternary system (Q^{ml}), with gravel cohesive soil, clay (Q^{el}), intense weathering volcanic rock ($\pi T_1 b$), and upper limestone in carboniferous system (C_3). The topography is higher in the west, northwest and northeast; and lower in the east and south.

131. The water supply of this subproject will be provided by nearby Jinjishan Water Supply Station in the south, which also provides potable water for residents in Puzhai Village. The subproject is not located within a protection zone for drinking water source.

132. Table 19 presents the **air quality** monitoring results from 27 February to 4 March 2016 in the EIT for the Pingxiang Border Trade and Logistics Center which is next to the subproject 6 site. These results were adopted as baseline conditions in the EIT for this subproject. The monitoring results represent only a snapshot in time and in space. The results indicate that on the days of monitoring and at the locations of monitoring, all monitored parameters complied with the GB 3095-1996 Class 2 standards. All monitored parameters also complied with WBG EHS AQG except PM_{10} at Banbu Village which slightly exceeded AQG but

complied with the interim target and at Guqie Village which exceeded the AQG but complied with the interim target. As PRC being a developing country, compliance with interim targets is deemed to be acceptable.

Table 19: Ambient Air Quality Monitoring Results for Subproject 6

Monitoring Location	Parameter Monitored	Concentration Range (µg/m^3)	GB 3095-2012 Class 2 Standard (µg/m^3)	WBG EHS Standard	
				Interim Target (µg/m^3)	AQG (µg/m^3)
1# Banbu Village	SO_2 (1-hr AVG)	7~32	500	n/a	n/a
	SO_2 (24-hr AVG)	9~11	150	50 – 125	20
	NO_2 (1-hr AVG)	11~20	200	n/a	200
	NO_2 (24-hr AVG)	11~20	80	n/a	n/a
	PM_{10} (24-hr AVG)	46~52	150	75 – 150	50
	TSP (24-hr AVG)	58~62	300	n/a	n/a
2# Guqie Village	SO_2 (1-hr AVG)	11~19	500	n/a	n/a
	SO_2 (24-hr AVG)	12~17	150	50 – 125	20
	NO_2 (1-hr AVG)	12~29	200	n/a	200
	NO_2 (24-hr AVG)	15~20	80	n/a	n/a
	PM_{10} (24-hr AVG)	60~67	150	75 – 150	50
	TSP (24-hr AVG)	76~88	300	n/a	n/a

Notes: **AQG** = air quality guideline; **AVG** = average; **EHS** = environmental health and safety; **NO_2** = nitrogen dioxide; **PM_{10}** = particulate matter with diameter <10µm; **SO_2** = sulfur dioxide; **TSP** = total suspended particulate; **WBG** = World Bank Group

Source: EIT

133. Table 20 presents the **noise** monitoring results in the EIT for the Pingxiang Border Trade and Logistics Center which is next to the subproject 6 site. These results were adopted as baseline conditions in the EIT for this subproject. The WBG EHS noise standards are more stringent than the PRC's GB 3096-2008 standards. Exceedance of the PRC standards automatically means exceedance of the WBG EHS standards as well. The noise monitoring results indicate that the acoustic environment in these areas have been under the influence of natural and human activities. Exceedance occurred mainly at night although day time exceedance also occurred occasionally. The EIT indicated that the influencing factors causing night time exceedance were noise from insects at the Pingxiang Border Trade and Logistics Center site and from community noise due to human activities at the two villages.

Table 20: Noise Monitoring Results for Subproject 6

Monitoring Location	Monitoring Date	Day Time Noise Level [L_{Aeq} = dB(A)]	Night Time Noise Level [L_{Aeq} = dB(A)]
1# East boundary of the Pingxiang Border Trade and Logistics Center	2016.02.28	48.7	46.0
	2016.02.29	48.4	40.5
2# South boundary of the Pingxiang Border Trade and Logistics Center	2016.02.28	58.6	50.7
	2016.02.29	60.5	50.0
3# West boundary of the Pingxiang Border Trade and Logistics Center	2016.02.28	46.2	47.3
	2016.02.29	54.9	49.5
4# North boundary of the Pingxiang Border Trade and Logistics Center	2016.02.28	54.6	51.7
	2016.02.29	54.3	49.7
5# Busha Village	2016.02.28	55.3	50.6
	2016.02.29	52.8	45.2
6# Kafeng Village	2016.02.28	49.9	52.5
	2016.02.29	54.5	51.6

Monitoring Location	Monitoring Date	Day Time Noise Level [L_{Aeq} = dB(A)]	Night Time Noise Level [L_{Aeq} = dB(A)]
GB 3096-2008 Category 2 standard:		**60**	**50**
WBG EHS standard:		**55**	**45**
Notes: exceed both GB and WBG standards exceed WBG standard but comply with GB standard			

Source: EIT

134. The nameless ditch that is 100 m south of the subproject site is a local drainage ditch for receiving overland runoff. It is about 3 m wide and 0.6 m deep, with a flow rate of about 0.02 m/s. Its **water quality** has been designated Category III standards in *Environmental Quality Standards for Surface Water* (GB 3838-2002) according to confirmation from local environmental protection bureau. Baseline surface water quality monitoring results conducted at the nameless ditch in January 2015 for the EIT for a nearby project, the China-ASEAN Agricultural Products Market Project (located about 900 m to the east of this subproject site) were adopted by the EIT for subproject 6. The monitoring results are presented in Table 21, showing exceedance of Category III water quality standard in chemical oxygen demand (COD) and total phosphorus (TP) indicative of potential influence from agricultural runoff and other human activities in the area.

Table 21: Results of Surface Water Quality Monitoring at the Nameless Ditch for Subproject 6

No.	Parameter	Monitoring Data			GB 3838-2002 Category III Standar
		2015.01.25	2015.01.26	2015.01.27	
1	Water temperature (^{o}C)	19.7	20.3	20.1	——
2	pH value	7.62	7.58	7.66	6~9
3	SS (mg/L)	Not detected	Not detected	Not detected	——
4	COD_{Cr} (mg/L)	25	18	15	20
5	BOD_5 (mg/L)	2.8	2.3	3.4	4
6	NH_3-N (mg/L)	0.246	0.269	0.352	1.0
7	COD_{Mn} (mg/L)	21.5	18.8	19.2	6
8	TP (mg/L)	0.21	0.20	0.20	0.2
Note: exceed Category III standard					

Source: EIT

D. Biological Resources, Ecology and Biodiversity

135. Field surveys and literature review undertaken during EIT preparation for the three subprojects revealed the absence of species that are under the national and/or international protection status within 1km of the subproject EIA sites. None of the plant/animal species are on the GZAR protection lists.

136. **Subproject 1: Construction of Fangchenggang Training Centre for Chinese and Vietnamese Workers and SMEs**. The area surrounding the subproject site is dominated by hilly terrain. Secondary woodland is prevalent, and the vegetation coverage rate is high. The trees in the secondary forest mainly consist of pine, maple and camphor. Planted species include pine, cedar and bamboo. Shrubs are mainly hill gooseberry and the shrub *Baeckea frutescens*. Herbaceous species are dominated by thatch, *Diranopteris dichotoma*, *Miscanthus floridulus*, and ferns. There are two ponds being used for shrimp culture nearby, the closest one being 500 m over the hill from the eastern boundary of the 'Fangchenggang Poly Tech Vocational School campus. The subproject site is within the Fangchenggang Poly Tech Vocational School campus, which is under construction and all vegetation has been removed from the site. The campus will be landscaped upon completion of civil works.

137. **Subproject 2: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone**. The subproject site is within the Youyiguan Industrial Park with frequent human activities. No ecologically sensitive area, rare or endangered animal or plant is distributed on the site. Main plants include common shrubs and farmland. Main animals are common birds, frogs and insects. The site and its vicinity have low ecological value.

138. **Subproject 6: Pingxiang Border Trade Service Center.** According to field investigation, the subproject assessment area is mainly farming area with commercial crops and fruit trees such as small-leaved eucalyptus, sugarcane and peanut. The land is relatively flat with sporadic hilly terrain. Vegetation includes planted species such as pines and eucalyptus trees, and shrub-grassland. There is no record of animals/plants with national, provincial or international protection status in the area. The subproject site and vicinity has been partially cleared for the construction of the Pingxiang Border Trade and Logistics Center and vegetation cover is low. Ecological value is deemed to be low.

139. **Wildlife trafficking.** ADB commissioned Wildlife Conservation Society to undertake an assessment of potential illegal wildlife trafficking and trade in border areas in the program area. Wildlife enforcement data, consultations and site visits indicate shows that Guangxi is a major wildlife trafficking trade center between Viet Nam and PRC. Key animals and their products include ivory, reptiles and turtles. Pingxiang is the main trade center for hard wood, such as rosewood. Many CITES appendix II species were found in the market without CITES permits. A detailed report is being prepared and will be included as an appendix to the IEE.

E. Socio-economic Conditions

1. Fangchenggang

140. **Administration Setting and Demographic Profile.** The proposed subproject Fangchenggang Training Centre for Chinese and Vietnamese Workers and SMEs -is located in Gangkou District of the prefecture-level city of Fangchenggang, which is administered under two urban districts (Gangkou and Fangcheng), one city (Dongxing) and one county (Shangsi). The total land area of Fangchenggang is 6,181 km^2. Fangchenggang had a total registered population of approximately 956,100 at the end of 2015, including 506,300 urban population (53.0%). Population density is approximately 155 persons per km^2. The population is made up of 21 ethnic groups such as Han, Zhuang, Yao, and Jing among which ethnic minority groups make up 48%. It is the only border-port city in the PRC,

regarded as 'the gateway of southwest China and a pearl at the Chinese border'.

141. **Economic Development**. In 2015, Fangchenggang's gross domestic product (GDP) reached CNY 62.1 billion, with an increase of 10.2% over 2014. Table 22 compares Fangchenggang GDP in 2015 with GZAR and national averages, showing that Fangchenggang per capita GDP was considerably higher than both GZAR and national averages. The newly added employees totaled at 26,000 persons. The average annual disposal income of urban residents was CNY 28,433 per capita, which was higher than the GZAR average. Similarly, the average annual net income of farmers was CNY 10,429 per capita, which was also higher than the GZAR average. The income levels for both urban and rural residents in Fangchenggang were lower than the national averages of CNY 31,195 and CNY 11,422 respectively. In the Fangcheng District, the poverty population is 2.99% of the district population of 426,100, with 42 poor villages and 2,958 poor households.

Table 22: Gross Domestic Product (GDP) Composition in Fangchenggang in 2015

Region	GDP (100 Million Yuan)	Primary Industry (%)	Secondary Industry (%)	Tertiary Industry (%)	Per Capita GDP (CNY)
PRC	676,708	9.0	40.5	50.5	49,351
GZAR	16,803.12	15.3	45.8	38.9	35,190
Fangchenggang	620.72	12.2	56.9	30.9	67,972

Source: PPTA consultant.

142. **Communication and Transportation.** As a burgeoning coastal industrial port city, Fangchenggang plays a leading role in the development of Beibu Gulf economic zone. It is the most convenient passage to the sea in southwestern PRC as well as the frontier position in the connection and communication between PRC and ASEAN countries. It is the biggest port in GZAR and has been establishing trade relations with over 180 countries and regions. Railroad from Nanning to Fangchenggang and expressway from Qinzhou to Fangchenggang connect the city with the railroad and highway network across the country. The mail and communication industry has been developing quickly with program-controlled telephone and mobile phone available all over the city. The telephone coverage reaches 80%. The communication system is dominated by regional communication and telecommunication information and is mainly provided through network information service center.

143. **Natural Resources.** Important mineral deposits in Fangchenggang include manganese, titanium, iron and granite. The proven reserve of manganese totals 750,000 tons, titanium 1,000,000 tons, iron 117,200 tons and granite 150 million m^3. Major agricultural crops include rice, corn, sweet potato, peanut, sugarcane, banana, pineapple and other tropical fruits. Forests account for more than 346,500 ha and forest coverage stands at approximately 57%.

144. There are four **protected areas**, three of which are national-level (the Beilunhe Estuary National Mangrove Nature Reserve, Shiwanda Mountain National Nature Reserve and Fangcheng *Jinhua* Tea National Nature Reserve). Protected areas account for 71,100 ha or 11.4% of the territory. None of them are within or close to the ecological assessment area of subproject 1.

145. **Tourism**. The long history, multiple ethnic culture, beautiful landscape and the clean sea

make Fangchenggang one of the most favoured tourist destinations in Guangxi. Tourist arrivals in 2014 amounted to 13.62 million or an increase of 15.0% and tourism revenues reached CNY 10.06 billion or an increase of 26.2% over 2014.

2. Pingxiang

146. **Administration Setting and Demographic Profile.** Pingxiang is a county-level city under the administration of the prefecture-level city of Chongzuo. Pingxiang administers 4 towns (Pingxiang, Youyi, Xiashi and Shangshi), 33 village committees, 8 residential committees and 260 villages. The total area of Pingxiang is 650 km^2 and the total population was 111,770 at the end of 2014, including 44,027 urban population (39.4%). Population density was approximately 172 persons per km^2.

147. **Economic Development**. The GDP of Pingxiang in 2015 increased by 11.7% over 2014, the fiscal revenue by 6.2%, the investment on fixed assets by 27%, the total exports and imports in local enterprises by 12.1%, the total consumer goods retail sales by 10.3%, the urban residents disposable income by 6.1%, and the rural net income per capita by 8.9%. In 2015, Pingxiang City strived in social and economic development. New record was set in international trade. The total exports and imports in local enterprises exceeded USD 10 billion, accounting for 20.43% of and ranking first in the GZAR. As for international trade, the proportion of small-amount cross-border trade increased by 16.71% and ranked first nationally. The import and export of fruit cargo quantity reached 1.41 million tons, which accounted for 21% of the national total. The Pingxiang Port is the largest port for import and export of fruits cargo in China. Table 23 presents the Pingxiang GDP in 2014, in comparison with GZAR and national averages. Pingxiang per capita GDP was higher than both national and GZAR averages.

Table 23: Gross Domestic Product (GDP) Composition in Pingxiang in 2014

Region	GDP (100 Million Yuan)	Primary Industry (%)	Secondary Industry (%)	Tertiary Industry (%)	Per Capita GDP (CNY)
PRC	636,463	9.2	42.6	48.2	46,531
GZAR	15672.97	15.4	46.8	37.8	33,090
Pingxiang	53.91	8.9	28.9	62.2	47,043

Source: PPTA consultant.

148. The average annual disposable income of urban residents in 2014 was CNY 25,877 per capita, which was higher than the GZAR average of CNY 24,669 but lower than the national average of CNY 28,844. The poverty population is 9.17% of the city population of 111,770, with 10 poor villages and 10,256 poor households.

149. **Transportation and Infrastructure.** Pingxiang City is a gateway t PRC's southern border, and Youyiguan is the channel for land transportation between PRC and Viet Nam. Hunan-Guangxi Railway and National Road G322 run through its downtown. With Pingxiang Railway Station, national Class 1 port (such as Youyiguan) and local port (such as Ping'er Gate), the city is the largest and most convenient land access from PRC to Southeast Asia. The international transport railway of Hunan-Guangxi Railway –Hanoi– Pingxiang – Beijing – Moscow runs through from north and south. In 2007, Pingxiang Port became the largest land port in the PRC. It leads the GZAR in efficiency and coordination mechanism of simplified customs clearance procedures.

150. **Tourism**. Pingxiang is a border tourism destination between PRC and Viet Nam. There are plenty of scenic and historic spots sites in the city, including the magnificent Youyiguan as one of the Top Nine Border Gates in the PRC; and the mysterious and beautiful Baiyu Cavity. Historic sites include ancient China-France Battlefield, Underground Great Wall at Pinggang Mountain, Ancient Fort Barbette on Jinji Mountain, Daliancheng City Wall and Mass Burial Ground from the Qing Dynasty. Historical and cultural landscapes include the Ancient Fort Barbette for Zhennanguan Revolt which is where Dr. Sun Yat-sen fired the first shot for revolt against the Qing Dynasty.

F. Physical Cultural Resources

151. The three subproject EITs have reviewed the status of cultural heritage within the subprojects' area of influence and concluded that no physical cultural resource exist within the subproject areas of influence. This was also confirmed by local cultural bureaus. Should buried artifacts of archaeological significance be uncovered during the construction stage within the project areas, construction will be stopped and immediately reported to the Fangchengang and Pingxiang Cultural Bureaus in accordance with the PRC's *Cultural Relics Protection Law* (2002) and *Cultural Relics Protection Law Implementation Ordinance* (2003).

G. Greenhouse Gas Emissions

152. Mitigating climate change through energy saving and sound management to reduce GHG emissions is a priority in Guangxi. In view of climate change risks to the province, Guangxi established a Provincial Climate Change Adaptation Office within the Guangxi Development and Reform Commission in August 2011 with 15 staff. This office assigns binding CO_2 reduction targets (per unit GDP) to cities in the province, which becomes a binding target for the Five Year Plans (FYP).

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Positive Impacts and Environmental Benefits

153. **Cost Efficient Labor Pool made available with Skilled Labor from Viet Nam**. The project will support Guangxi's pilot of bringing in foreign labor, in this case workers from Viet Nam. Training facilities will be established and training programs provided to workers from Viet Nam as well as local workers from within and outside the border areas. Tranche 1 will include two training facilities in Fangchenggang (subproject 1) and Pingxiang (subproject 2) respectively. The Fangchenggang training center will provide training space on automotive repair, machinery, electronics and trade and commerce on the campus of the Fangchenggang Poly Tech Vocational School, helping Chinese and Vietnamese workers and SMEs obtain technical skills in these fields. The cross-border labor cooperation demonstration park in Pingxiang will provide skill development and exchange for employment and business ventures, training facilities and office space.

154. Tranche 1 will also support the improvement of training quality for Vietnamese and Chinese workers and local SMEs in the prefecture-level cities of Fangchenggang, Chongzuo and Baise (subproject 3). Tailor-made training programs in collaboration with local

universities will be developed to help the SME labor force in these border areas and from Viet Nam to enhance technical and language skills.

155. **Good and Reliable Access to Finance**. Tranche 1 will provide credit support to SMEs in Fangchenggang, Chongzuo and Baise through a financial institution using an entrusted loan modality (subproject 4). Under this modality, the Bank of Communication Nanning Branch will act as an intermediary between the GZAR government and SME borrowers. Loans, particularly for working capital, will be granted by the bank to eligible SMEs involved in cross-border trade in agribusiness, logistics, manufacturing and border tourism sectors in the above localities. Both the bank and the eligible SMEs must demonstrate commitment to adopt and implement ADB's safeguard standards.

156. **Strengthening of Business Development Services for SMEs**. The project will improve the provision of business development services in Fangchenggang, Chongzuo and Baise (subproject 9). The objectives of the business development services program are (i) to develop a more comprehensive mechanism under the SME category; and (ii) strengthening the SME support capabilities of local government authorities, existing SME service organizations such as service centers and business incubators, educational institutions, bank and non-bank financial institutions, emerging internet-based services, and local private sector providers of professional services. This business development services system will directly assist SMEs in areas of product research and development, marketing and branding, human resource management, and financial management. The improved business development services will contribute to the development of efficient and effective supply chains and enterprise clusters in the border areas of Guangxi.

157. **Improved Cross-border Financial Transactions and Investments**. Tranche 1 will include a study to explore the demand from SMEs for cross-border financial services, such as payments and settlements systems and guarantees against non-commercial risks, and recommend options for their provision in subsequent tranches. This will improve the cost-competitiveness, safety and expeditiousness in cross-border financial transactions and investments.

158. **Development of New Technologies such as e-commerce to Facilitate Access to Markets**. The project will help establish and/or improve logistics service platforms to remove bottlenecks at cross-border check points (subproject 5), which have impeded the cross-border e-commerce operation. It will also implement measures to improve customs and sanitary and phytosanitary services as they are related to e-commerce. An e-commerce cross-border logistics service platform will be put in place in the Longbang BEZ with real-time trade-logistics data exchange and trade process optimization. It will improve the effectiveness and efficiency in truck inspection, customs inspection and clearance, sanitary and phytosanitary services, supply chain management services, and cross-border order management.

159. **Improved Border Trade Infrastructure and Trade Related Services**. Tranche 1 will expand the border trade service center in Pingxiang to provide improved customs inspection and sanitary and phytosanitary services, warehouses and other ancillary facilities. This will facilitate trade between the residents living on both sides of the border and will provide better services and shopping experience to the Chinese and international tourists which are rapidly increasing in number in recent years.

B. Impacts Associated with Project Location, Planning and Design

160. The proposed project will involve permanent land take for the construction of buildings and facilities in subprojects 1, 2 and 6, which is an irreversible impact from permanent change of land use and landscape. However, permanent land take for the three subprojects is relatively small, totaling approximately 16.3 ha (3.5 ha for subproject 1, 1.8 ha for subproject 2, and 11.0 ha for subproject 3). For subproject 1, all the buildings are located on the existing Fangchenggang Poly Tech Vocational School campus. For subproject 2, the site is within the existing Youyiguan Industrial Park. For Subproject 6, the site is located within an area zoned for commercial and business land use. In view of the small sizes of these sites and their locations and existing land uses, permanent land take impact though irreversible is deemed to be not significant. There will be no temporary land take since all construction staging activities will be conducted within these sites.

C. Measures during Detailed Design and Pre-Construction

161. **Measures during Detailed Design**. The FSRs for subprojects 1 and 2 have included the requirement for designing barrier-free universal access to the buildings and facilities. The FSR for subproject 6 however has no mention of such features. Barrier-free universal access shall also be included in the design of the facilities in subproject 6. Detailed design of the buildings and facilities for all three subprojects shall also include energy saving features identified in the FSRs, which include materials for the outer wall, windows and roofs; electrical system and automation; air conditioning and ventilation; and light fixtures, etc. Technical design of training facility in subproject 2 and cold storage warehouse using liquid ammonia as coolant shall also incorporate environmental protection measures, as described below and in EMP.

162. The following environmental measures shall be included in the detailed design of the buildings and facilities for subprojects 1, 2 and 6:

(i) Technical design of buildings and facilities shall include barrier-free universal access
(ii) Technical design of buildings and facilities shall include energy saving features in terms of building materials, electrical system and automation, water heating, air conditioning and ventilation, and lighting, etc. as recommended in the FSRs
(iii) Technical design of buildings and facilities shall consider other “green building” features besides energy saving, such as the use of recycled building materials, rainwater capture and reuse, green roofs, etc..
(iv) A high design standard shall be adopted in the stabilizing slope design for all slopes on the subproject 1, 2 and 6 sites.
(v) In subproject 1, noise monitoring shall be undertaken at the façade location of training building #3 to determine the level of traffic noise from the Port-Dongxing Class 1 Highway. If the day time noise level exceeds 60 dB(A), technical design of the training building #3 shall include noise insulated windows in accordance with GB 50118-2010 *Design Specifications for Noise Insulation of Buildings for Civil Use* 《民用建筑隔声设计规范》
(vi) In subproject 1, technical design of the drainage system for the Fangchenggang Poly Tech Vocational School shall adopt an 8% increase over the current standard as an adaptation measure for extreme rainfall due to climate change.
(vii) Technical design of the drainage system in subprojects 2 and 6 shall adopt a 10% increase over the national standard as an adaptation measure for extreme rainfall due to

climate change.

(viii) Technical design of the training center in subproject 2 shall include activated carbon absorbent for VOC removal and fabric filter for removal of dust composed of fine particulate matters.

(ix) Technical design of the liquid ammonia storage room for the cold storage warehouse in subproject 6 must comply with the requirements in PRC's GB 18597-2001 *Standard Pollution Control on Hazardous Waste Storage*.

163. During the PPTA stage site visits, the implementing agencies for the three subprojects were advised of the Leadership in Energy and Environmental Design (LEED)[17] certification scheme under the United States Green Building Council, and were encouraged to adopt green building design and construction features listed in the scheme and to apply for LEED certification for their facilities.

164. **Measures during Pre-Construction.** A number of environmental management measures shall be implemented in the pre-construction phase for the three subprojects to ensure environment management readiness. These include:

(i) The PMO, as the executing agency, shall complete the following prior to construction commencement:
   (a) Establish a project-specific grievance redress mechanism (GRM) including a complaint hotline.
   (b) Appoint qualified staff as the environmental focal point to oversee EMP implementation.
   (c) Appoint the project management consultant (PMC) (under subproject 10). The PMC shall have an environmental specialist on the team to undertake the role of external (third-party) environmental monitor (EEM) during loan implementation.
   (d) Include specifications for environmental protection in all civil works tender documents and contracts.
   (e) If necessary, update the EMP to reflect changes made (such as changes in construction methods and building layout, etc.) during the detailed design.

(ii) Each project implementation unit (PIU), as the implementing entity for the respective subprojects, shall complete the following prior to construction commencement:
   (a) Appoint a qualified staff as the environmental focal point responsible for EMP implementation.
   (b) Appoint an environmental supervision engineer (ESE,环境监理) responsible for the environmental supervision of contractors and environmental audit of construction sites for the subproject.
   (c) Appoint an environmental monitoring station (EMS, 环境监测站) to undertake environmental monitoring according to the EMP during construction and operation of the subproject.

D. Impacts and Mitigation Measures during the Construction Stage

165. **Impact Screening.** Construction activities will include site formation and construction of buildings and ancillary facilities such as internal roads and walkways, drainage system and

[17] Leadership in Energy and Environmental Design: http://www.usgbc.org/leed

landscaping etc. Potential environmental impacts arising from such activities would include air quality, noise, water quality, ecology, solid waste, and occupational health and safety.

166. Potential air quality impacts could occur due to fugitive dust generated on the construction site during earth works, from stockpiles of uncovered earth materials, and exhaust from construction equipment and vehicles. The use of powered mechanical equipment (PME) during construction activities will generate noise. Construction activities will generate process wastewater and construction workers will produce wastewater. Permanent land take might result in loss of vegetation. Construction works will produce construction and demolition (C&D) wastes and construction workers will generate refuse. Workers will face occupational health and safety issues working on construction sites, such as above ground construction works and exposure to volatile organic compound (VOC) from paints and other organic solvents during interior fit-out. These potential impacts are assessed and addressed below. Land contamination would not be an issue in this project since there has been no industrial activity within the construction footprint of the subprojects.

1. Impacts and Mitigation Measures on Physical Resources

167. **Air Quality.** Main air pollutants during the construction stage in this project include (i) fugitive emissions of dust during earth works and from uncovered stockpiles, (ii) fumes and exhaust from construction vehicles and machinery, and (iii) fugitive emissions of VOC from paints and organic solvents during interior fit-out of buildings and facilities. Premixed asphalt and/or concrete will be purchased commercially and the subprojects will not set up asphalt mixing or concrete batching plants on site.

168. The EITs estimated that the impact area of fugitive dust from construction sites would be confined to within 200 m from the boundary of the construction site if no mitigation measure is adopted. For subproject 1 this will mainly affect the students and staff on the campus of the Fangchenggang Poly Tech Vocational School, as well as the Shamuwan Village Shiping Group (approximately 150 residents) at approximately 450 m east of the campus and the staff and students (approximately 2,000) on the campus of Guangxi College of Finance and Economics at approximately 30 m west of the vocational school. For subproject 2, there are eight households with approximately 35 residents about 180 m to the east of the demonstration park site. For subproject 6, Kafeng Village (population 500) is located approximately 130 m south-east of the border trade service center. For exhaust from construction vehicles and machinery, the EIT estimated that the NO_2 emitted from these sources would comply with the *Ambient Air Quality Standards* (GB 3095-2012) Class 2 standard at a distance of 50 m from the source. Potential impact would therefore be confined to students and staff who are in close proximity to the building sites on the Fangchenggang Poly Tech Vocational School campus. Fugitive emission of VOC from paints and organic solvents during interior fit-out would mainly affect the construction workers on site and is thus an occupational health issue.

169. The Contractor shall include all necessary mitigation measures to reduce air pollution that would impact public and occupational health, by implementing the following air quality control measures. Some of these measures are generic measures that are applicable to all construction sites and construction activities. Yet these are effective measures and are also described in WBG's EHS guidelines.

(i) Spray water at least twice each day on unpaved areas and exposed dust-prone

stockpiles except on rainy days.

(ii) Store dust-prone materials in areas with shelters on four sides and on top. If such materials have to be stored in open area, cover with strong tarpaulin.
(iii) Control vehicle speed to ≤ 8 km/h in unpaved areas. Post the speed limit sign in these areas.
(iv) Pave construction site exits with gravel or asphalt.
(v) Install wheel washing equipment or conduct wheel washing manually at each construction site exit to prevent trucks from carrying muddy or dusty substance onto public roads.
(vi) Vehicles with an open load-carrying case, which transport potentially dust-producing materials, shall have proper fitting sides and tail boards. Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with a strong tarpaulin.
(vii) Provide personal protective equipment (PPE) such as goggles, gloves and respirators to construction workers doing interior fit-out to minimize skin exposure to chemicals and inhalation of VOC.
(viii) Regularly maintain construction vehicles and machinery to minimize exhaust emissions from these sources.
(ix) Unauthorized burning of construction and demolition waste material and refuse shall be subject to penalties for the Contractor, and withholding of payment.

170. These measures are defined in the EMP. Contractors are required to ensure compliance with relevant PRC emission standards. Air quality monitoring will be carried out by a licensed environmental monitoring entity (external) during the construction period. Potential air quality impacts during the construction stage would be of short duration and localized. With the above mitigation measures in place, potential air quality impacts during the construction stage would be reduced to acceptable levels.

171. **Noise**. Noise is emitted by PME used during construction and construction vehicles travelling to and from the construction sites. Most noisy activities would include piling works and during the use of excavators, electric saws, breakers and external elevators (for transporting materials and workers to upper floors), with sound power levels of 105 dB(A) and higher if a combination of such equipment is deployed. Based on these sound power levels, the EITs estimated that the day time [70 dB(A)] and night time [55 dB(A)] noise limits in *Emission Standard of Environmental Noise for Boundary of Construction Site* (GB12523 -2011) would be met at distances of 50 m and 200 m beyond the boundary of the construction site without any noise mitigation measure. For subproject 1, construction noise impact would affect students and staff on the campus of the vocational school and the Guangxi College of Finance and Economics during day time and night time (both schools have staff and student dormitories). The Shamuwan Village Shiping Group is separated from the vocational school campus in Fangchenggang by a slope and does not have a direct line of sight to the campus and therefore is unlikely to be affected by construction noise generated on the campus. For subprojects 2 and 6 in Pingxiang, residents in the eight households at 180 m to the east of the demonstration park and the Kafeng Village at 130 m to the south-east of the cross border trade serve center would be affected at night if night time construction occurs at these sites with no mitigation.

172. Contractors shall be required to implement the following mitigation measures for construction activities to meet PRC construction site and WBG recommended noise limits and to protect sensitive receptors. Some measures are generic and are applicable to all

construction sites and activities. Yet they are effective measures and are also in line with WBG's EHS guidelines. The use of temporary noise barriers or hoardings to shield off construction noise is particularly relevant to the construction of buildings and facilities on the Fangchenggang Poly Tech Vocational School site where students and staff will be having classes in nearby buildings on campus. Noisy construction activities shall also be avoided during examination periods.

(i) No construction works shall be conducted between 22:00 to 06:00 hours. Piling works shall also be prohibited between 12:00 to 14:30 hours.
(ii) During construction, the contractor shall:
  (a) ensure regular equipment repair and maintenance to keep them in good working condition to minimize noise
  (b) deploy low noise machinery or the equipment with sound insulation
  (c) erect temporary noise barriers or hoardings around noisy equipment to shield the noise from equipment
  (d) provide the construction workers with suitable hearing protection (ear muffs) when working near noisy machinery such as during piling
  (e) forbid the use of horns unless absolutely necessary, minimize the use of whistles

173. The World Bank Group's EHS guideline also provides the following guidance to mitigate noise and vibration impacts caused by the operation of pile drivers, earth moving and excavation equipment, concrete mixers, cranes and the transportation of equipment, materials and people during construction and decommissioning activities:

(i) Plan activities in consultation with local communities so that activities with the greatest potential to generate noise and vibration are planned during periods of the day that will result in least disturbance.
(ii) Use noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines.
(iii) Avoid or minimize project transport through community areas.

174. Noise impacts during construction would be of short duration. Potential sensitive receptors will be exposed to short term, temporary and localized impacts. With the above mitigation measures in place, potential noise impacts during construction would be reduced to acceptable levels.

175. **Water Quality.** Uncontrolled wastewater and muddy runoff from construction sites could potentially pollute nearby water bodies and clog up drains. Discharge of domestic wastewater generated by the construction workers could also pollute nearby water bodies if not treated. The EITs estimated that process wastewater for the subprojects would contain approximately 250 mg/L suspended solids (SS) and 20 mg/L total petroleum hydrocarbon (TPH). Process wastewater would be treated by oil-water separation then sedimentation on the construction site. The process wastewater after treatment would be used for dust suppression on site resulting in no discharge of process wastewater from the construction sites.

176. Domestic wastewater generated by the construction workers has been estimated by the EITs to range from 8 m^3/d to 20 m^3/d for the subprojects depending on the number of construction workers on site at any given time. Major pollutants are chemical oxygen demand (COD), biochemical oxygen demand (BOD), suspended solids (SS) and ammonia

nitrogen (NH_3-N). For subproject 1 the vocational school in Fangchenggang has installed an underground package wastewater treatment plant with a treatment capacity of 2,500 m^3/d, treating wastewater to Class 1 standard specified in *Integrated Wastewater Discharge Standard* (GB 8978-1996) before discharging through local sewer network into the sea at Xiwan. The construction workers would use toilet facilities on the campus and the wastewater would be properly treated prior to discharge. For subproject 2 the demonstration park in Pingxiang, the domestic wastewater from construction workers would be treated by septic tanks installed on the construction site. For subproject 6 the cross-border trade services center in Pingxiang, domestic wastewater generated by the construction workers would be collected and conveyed to the wastewater treatment station at the existing neighboring cross-border trade logistic center for treatment.

177. The contractors will implement the following mitigation measures to prevent water pollution:

(i) Collect runoff from construction sites with drainage ditches to prevent runoff containing muddy water from polluting nearby roads, land and water bodies.
(ii) Install and operate oily-water separators and sedimentation tanks on construction sites to treat process water and muddy runoff with high concentrations of total petroleum hydrocarbon and suspended solids. If necessary, use flocculants such as polyacryl amide (PAM) to facilitate sedimentation.
(iii) Provide portable toilets and small package wastewater treatment plants and/or septic tanks on construction sites for the workers. If there are nearby public sewers, install interim storage tanks and pipelines to convey wastewater to public sewers.
(iv) Store fuels, oil, and other hazardous materials on construction sites within secured areas on impermeable surfaces protected by bunds and provided with cleanup kits.
(v) Clean up any chemical spills into drains and water bodies within 24 hours of the occurrence, with contaminated soils and water treated according to HJ 25.4-2014 *Technical Guidelines for Site Soil Remediation*. Records must be handed over without delay to the PMO and local EPB.

178. With the above measures in place, potential water quality impact should be mitigated to acceptable levels.

179. **Solid Waste**. Solid waste generated during construction will include refuse generated by construction workers on construction sites and construction and demolition (C&D) waste generated during site formation and building construction. The EITs estimated that the quality of refuse generated by construction workers on the construction sites would be less than 0.1 t/d. Refuse bins will be provided on construction sites for collection of refuse, which would then be collected by local sanitation bureaus regularly for disposal. For subproject 1, the Fangchenggang Poly Tech Vocational School campus is under construction and the sites for the buildings in subproject 1 would have been formed by the time construction for these buildings commences. The sites for other two subprojects would require import of fill for site formation. All three subprojects therefore would not produce excavated spoil materials needing disposal. The EITs estimated that for each m^2 of floor area to be constructed approximately 50-60 kg of C&D waste would be generated. The three subprojects combined would therefore generate approximately 4,600 t C&D waste. Reuse and recycling of C&D waste on site would be considered first. Those that cannot be reused would be transported to locations designated by local construction authorities for storage or disposal of C&D waste.

180. The contractors will implement the following mitigation measures to manage C&D waste and refuse generated during construction:

(i) Maximize the re-use of C&D wastes on the project.
(ii) Store all refuse and C&D waste generated on construction sites in designated areas and remove them from these locations for disposal or reuse regularly.

181. With the above measures in place, solid waste generated during construction should have minimal environmental impact.

2. Impacts and Mitigation Measures on Biological Resources, Ecology and Biodiversity

182. The three subproject sites and vicinity have been assessed to have low ecological value. The Fangchenggang Training Center for Chinese and Vietnamese Workers and SMEs (subproject 1) will be constructed on the existing campus of the Fangchanggang Poly Tech Vocational School. The site has been cleared with vegetation removed and part of the campus is already under construction (see Figure 5). The site in its present form has no ecological value. The site for the Cross-border Labor Cooperation Demonstration Park (subproject 2) is located in the Pingxiang Border Economic Zone. Part of the site has already been cleared and leveled and other parts are covered by mainly shrubs and grass (Figure 6). The site for the Pingxiang Border Trade Service Center is located within the area zoned for commercial and financial land use, and is found to be dominated by common and planted trees, shrubs and grassland. Field surveys and literature review undertaken during EIT preparation and by PPTA consultants for the three subprojects revealed the absence of national, provincial and international protected flora and fauna species within the ecological area of influence. The sites are not located in any protection area. Total land take by the three subprojects would be small, approximately 16.3 ha. Upon completion of civil works, all the three sites will be landscaped to improve amenity and aesthetic value for the users and the environment. Ecological impact is anticipated to be minimal. The contractors will implement the following mitigation measures during construction for protection of biological resources.

(i) Construction workers are prohibited from capturing any wildlife during construction.
(ii) Where a tree has to be removed or an area of grassland disturbed, replant trees and re-vegetate the area after construction. Tree planting shall use local species with local provenance. Planting of exotic of invasive species shall be prohibited.

3. Impacts and Mitigation Measures on Socio-economic Resources

183. **Land Acquisition and Resettlement**. Land for all three subprojects was acquired prior to ADB funding and not in anticipation of ADB funding. The land for subprojects 1 and 2 was acquired in 2013 and the land for subproject 6 was acquired in 1993. No additional land acquisition, house demolition and resettlement would be induced as a result of this project. It was confirmed that all land acquisition undertaken by local governments was in compliance with applicable PRC laws and regulations and there would be no pending land acquisition and resettlement issue.

184. **Physical Cultural Resources.** Assessment undertaken did not reveal the presence of physical cultural resources within the footprints of the three proposed subproject sites. Should buried artifacts of archaeological significance be uncovered during the construction stage within these sites, construction will be stopped and immediately reported to the local cultural buearus in accordance with PRC's *Cultural Relics Protection Law* (2002) and the *Cultural Relics Protection Law Implementation Ordinance* (2003).

185. **Occupational Health and Safety.** Due to its nature the construction industry is considered to be one of the most hazardous industries where a number of potentially hazardous operations are carried out. The contractors will implement the following measures and precautions to protect the health and safety of construction workers.

(i) Environment, health and safety officer: Each contractor shall appoint at least one environment, health and safety (EHS) officer to manage occupational health and safety risks on construction sites by applying the following measures.

(ii) Construction site sanitation: (i) Each contractor shall provide adequate and functional systems for sanitary conditions, toilet facilities, and waste management with waste separation; (ii) Effectively clean and disinfect the site. During site formation, spray with phenolated water for disinfection. Disinfect toilets and refuse bins and ensure timely removal of solid waste; (iii) Exterminate rodents on site at least once every 3 months, and exterminate mosquitoes and flies at least twice each year; (iv) Provide public toilets in accordance with the requirements of labor management and sanitation departments in the living areas, if any, on construction site, and appoint designated staff responsible for cleaning and disinfection; (v) Construction site domestic wastewater shall be discharged into the municipal sewer system or treated on-site using a portable system.

(iii) Occupational safety: (i) Provide personal protective equipment (safety hats and shoes, high visibility vests, and safety belt and harness for above ground works) to all construction workers and strictly enforce all workers to put on the PPE; (ii) Provide safety goggles, gloves and respiratory masks to workers doing interior fit-out works; (iii) Provide ear plugs to workers operating and working near noisy PME.

(iv) Food safety: (i) Inspect and supervise food hygiene in canteens, if any, on site regularly. Canteen workers must have valid health permits. If food poisoning is discovered, implement effective control measures immediately to prevent it from spreading.

(v) Disease prevention, health services: The following disease prevention measures and health services shall be undertaken: (i) Construction workers must have physical examination before start working on site. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. From the second year onwards, conduct physical examination on 20% of the workers every year; (ii) Establish health clinic at location where workers are concentrated, which should be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents; (iii) Provide induction and training by local health departments on prevention and management of communicable diseases.

(vi) Social conflict prevention: No major social risks and/or vulnerabilities are anticipated as a result of the project. The project construction workers will be engaged locally. Civil works contracts will stipulate priorities to (i) employ local people for works, (ii) ensure equal opportunities for women and men, (iii) pay equal wages for work of equal value, and to pay women's wages directly to them; and (iv) not employ child or forced labor. In addition, subproject 3, provides specific support for improvement of the training curriculum for Vietnamese and Chinese workers and local SMEs, including cultural etiquette and considerations.

186. **Community Health and Safety.** Temporary traffic diversions, continual generation of noise and dust on haulage routes, and general hindrance to local access and services are common impacts associated with construction works within or nearby local settlements. The potential impacts on community health and safety will be mitigated through a number of activities defined in the EMP.

187. The contractors will implement the following measures:

(i) Traffic management: A traffic control and operation plan shall be prepared together with the local traffic police prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.

(ii) Information disclosure: (i) Construction billboards, which include construction description, schedule, responsible person and complaint phone number, shall be erected at the entry to each construction site and construction staging area. (ii) Residents and businesses shall be informed in advance of noisy construction activities such as piling, given the dates and duration of expected disruption and made aware of the project GRM.(iii) Clear signs shall be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations etc. and raising awareness on safety issues.

(iii) Construction sites: All sites shall be made secure, discouraging access by members of the public through appropriate fencing, signage and/or security personnel, as appropriate.

188. **Utilities Provision Interruption.** Construction may require relocation of municipal utilities such as power, water, communication cables. Temporary suspension of services (planned or accidental) can affect the economy, industries, businesses and residents' daily life. Mitigation of impacts on utilities provision will be through a number of activities defined in the EMP, to be incorporated in the tender documents and construction contracts:

(i) Contractors shall assess construction locations in advance and identify potential for disruption to services and risks before starting construction. Any damage or hindrance/disadvantage to local businesses caused by the premature removal or insufficient replacement of public utilities is subject to full compensation, at the full liability of the contractor who caused the problem.

(ii) If temporary disruption is unavoidable the contractor shall, in collaboration with relevant local authorities such as power company, water supply company and communication company, develop a plan to minimize the disruption and communicate the dates and duration in advance to affected persons.

E. Impacts and Mitigation Measures during the Operational Stage

189. **Impact Screening**. During operation, subproject 2 the cross-border labor cooperation demonstration park in Pingxiang would have air quality and occupational health impacts. This subproject will have a training center providing training on the finishing of small home appliances requiring paint spraying releasing VOC, red wood furniture sanding and polishing generating dust and fine particulate matters, and oven drying of nut products generating smoke. Operational noise would not be an issue for all three subprojects since the activities

would be conducted inside buildings. All three subprojects would have water quality impact from the discharge of domestic wastewater containing COD, BOD, SS and NH_3-N from people using these facilities and living in the dormitories, as well as some process wastewater containing mainly SS from subproject 2 due to training activities described above. All three subprojects also have municipal solid waste (MSW) generated from the people using these facilities and living in the dormitories. Subproject 6 would also have an environmental risk issue from the storage of liquid ammonia as a coolant for cold storage. These impacts and respective mitigation measures are described below.

1. Impacts and Mitigation on Air Quality

190. Subproject 2 the cross-border labor cooperation demonstration park in Pingxiang will provide training to Vietnamese and Chinese workers on the finishing of small home appliances, red wood furniture and nut products. Finishing of small home appliances would involve paint spraying, which would emit VOCs during the process. Finishing of red wood furniture would require sanding and application of protective polish, which would generate dust composed of fine particulate matters and also VOCs. Oven drying of nut products would generate steam. The design of the training center according to the EIT shall include the provision of activated carbon absorbent and fabric filter to prevent VOC and fine particulate matters from escaping into the atmosphere. This requirement has also been included in the EMP and described above as a means of mitigation to be incorporated into the building design during the design stage. The key issue therefore relates to the health and safety of the teachers and students undertaking these activities inside the training center and the following mitigation measure shall be implemented during the operation of the training center in subproject 2.

(i) For subproject 2, the staff and students in the training center shall be provided with PPE such as goggles, respirators and ear plugs for health and safety protection from VOC, fine particulate matters and noise during training.
(ii) Staff and students will also be fully trained on use, handling, storage of any potentially hazardous substances that may pose a risk to human health

2. Impacts and Mitigation on Water Quality

191. For subproject 1, domestic wastewater generated by the staff and students using the facilities on the Fangchenggang Poly Tech Vocational School would be collected and conveyed to the underground package wastewater treatment plant with a treatment capacity of 2,500 m^3/d on campus, treated to Class 1 standard prescribed in GB 8978-1996 *Integrated Wastewater Discharge Standard*, then discharged to the sea at Xiwan via public sewer.

192. For subproject 2, domestic wastewater from the people using the facilities and from the canteen at the cross-border labor cooperation demonstration park in Pingxiang has been estimated to be approximately 272 m^3/d, and would be treated with septic tanks before discharging into municipal sewer for further treatment at the Xiashi Town WWTP, which was commissioned in August 2016. Wastewater from the canteen would go through oil-water separation first before entering the septic tanks. Process wastewater from the training center, which would contain small quantities of suspended solids, would go through sedimentation on site. The wastewater after sedimentation would be re-used on site for site cleaning and

irrigation.

193. For subproject 6, domestic wastewater from the people using the facilities at the border trade service center in Pingxiang has been estimated by the EIT to be approximately 114 m^3/d. This will be collected and conveyed to the wastewater treatment station on the neighboring Pingxiang Border Trade Logistics Center for treatment. Upon completion of the Kafeng Wastewater Treatment Plant, domestic wastewater from subproject 6 would be conveyed to this WWTP for treatment.

194. The quantities of wastewater generated during operation of the three subprojects are relatively small. All wastewater would be properly collected and treated. Potential adverse impact on water quality is not anticipated.

3. Impacts and Mitigation on Solid Waste

195. The quantities of municipal solid waste (MSW) generated by the people using the facilities in the three subprojects would be relatively small, estimated by the EITs to be approximately 2 t/d for subproject 2 and 6.8 t/d for subproject 6. Such MSW would be regularly collected by local sanitation bureaus for proper disposal at either the Fangchenggagng Municipal Solid Waste Treatment Center (treatment capacity 300 t/d) or the Pingxiang Municipal Solid Waste Resource Reuse Treatment Center (treatment capacity 150 t/d). The training center in subproject 2 would also have small quantities of chemical waste, including metal chippings and oily clothes. These will be collected by companies approved for the handling and treatment of chemical waste, for rendering non-toxic prior to disposal. According to permitting information on the web-site of the Guangxi Environmental Protection Department, there are 25 licensed hazardous waste operators in the GZAR as of December 2015. The following mitigation measures have been specified in the EMP for subproject 2.

(i) Chemical and other hazardous waste generated from the training center in subproject 2 shall be collected by company approved to collect and treat chemical waste.

4. Environmental Risk from Liquid Ammonia

196. Subproject 6 provides warehousing for storage of nut products and produce, which includes cold storage using liquid ammonia as a coolant. Ammonia is a colorless gas and an irritant, having a freezing point of -77.7 ^oC, a boiling point of -33.5 ^oC, and a relative density (with air) of 0.59. The EIT for subproject 6 indicated that based on laboratory toxicity test using rats, its LC_{50}[18] was found to be 1,390 mg/m^3 after inhalation for four hours, and the maximum allowance concentration for short time exposure was 30 mg/m^3. Inhalation of liquid ammonia would cause irritation to the mucosa in the body. Exposure to liquid ammonia would result in burning sensation to the eyes and skin. Inhalation of low concentrations would cause running tears, painful pharynx and coughing. More serious effects would include pulmonary edema. Inhalation of high concentrations would cause necrosis of the mucosa, resulting in asphyxiation, acute intoxication and fatality.

197. The EIT for subproject 6 undertook an environmental risk assessment for accidental

[18] LC_{50} is the lethal concentration that causes 50% mortality on the number of animals used in the laboratory toxicity test.

leakage of liquid ammonia from the cold storage in accordance with HJ/T 169-2004 *Technical Guideline for Environmental Risk Assessment of Construction Project*. According to HJ/T 169-2004 the threshold for liquid ammonia storage to be deemed a "major source of danger" is 10 t. Based on the EIT, the maximum quantity of liquid ammonia to be stored on site at any given time would be 5 t. The cold storage site is therefore not a "major source of danger". Based on HJ/T 169-2204 technical guideline, the EIT assumed a liquid ammonia leakage incident lasting 20 minutes, at a rate of 0.158 kg/s. Numerical modeling was conducted to predict the dispersion of ammonia gas from 5 – 10 minutes after leakage. Results show that from 5 to 20 minutes after leakage, the maximum ground level concentration of ammonia would be 734.87 mg/m^3 and the plume would be confined to within a distance of 25.8 m from the point of leakage. After 25 minutes the maximum ground level concentration would decrease to 2.66 mg/m^3 and would occur at a distance of approximately 900 m from the point of leakage. After 30 minutes the maximum ground level concentration would be further reduced to 0.79 mg/m^3 and would occur at a distance of approximately 1.77 km from the point of leakage.

198. The above prediction indicates that the impact from the ammonia plume due to accidental leakage at the cold storage site would potentially affect an area within 26 m from the point of leakage for the first 20 minutes. Within this zone for the first 20 minutes, the maximum ground level concentration is approximately 53% of the LC_{50} concentration of 1,390 mg/m^3 and exceeds the maximum allowance exposure concentration of 30 mg/m^3. The impact of ammonia due to accidental leakage from the cold storage would therefore be confined to a distance of approximately 26 m lasting for 20 minutes from the point of accidental leakage.

199. The nearest sensitive receptor to the cold storage site was originally Kafeng Village at a distance of 113 m to the southeast, followed by Busha Village at a distance of 352 m to the southwest, and Kafang Village at a distance of 358 m to the south. The EIT specified buffer distances of 300 m downwind of the highest frequency summer wind direction and 150 m for other wind directions for separating the cold storage site from the nearest villages. As a result of this specification in the EIT, the cold storage site was moved to its present location at the northern end of the warehouse as shown in Figure 4. The present location is 336 m from Kafeng Village, 357 m from Busha Village, and 474 m from Kafang Village. The EIT also specifies that the design of liquid ammonia storage room must comply with the requirements in GB 18597-2001 *Standard Pollution Control on Hazardous Waste Storage*. This has been specified in the EMP under environmental protection measures during the detailed design stage. The following mitigation measure and assurance has also been included in the EMP.

(i) Handling and storage of liquid ammonia shall conform to the *Dangerous Chemicals Safety Management Ordinance*, 2011
(ii) For the cold storage warehouse in subproject 6, the maximum allowable quantity of liquid ammonia stored on site shall not exceed 5 tons at any given time.
(iii) An emergency response plan for liquid ammonia leakage shall be prepared.
(iv) PPE such as goggles and respirators shall be placed in conspicuous locations outside the liquid ammonia storage room for use by all workers inside the room.
(v) Workers shall be trained on the handling of liquid ammonia drums, the use of the cold storage facility, and emergency response should liquid ammonia leakage occur.

5. Greenhouse Gas Emissions and Energy Efficiency

200. All the facilities in all three subprojects use electricity supplied by the local power companies. The mild winter climate in Guangxi does not need boiler heaters in the winter. There is no greenhouse gas emission during the operation of these facilities.

201. Based on the FRSs, the design of these facilities will include energy efficient and energy saving features. These include optimizing the layout of electrical cables to minimize power loss, using energy efficient transformers and optimize their numbers and locations, optimizing the locations of the switch boxes to reduce power loss during transmission, zoning of lighting areas, lighting motion detectors, optimizing illumination intensity, maximizing the use of natural light for illumination, and using solar water heaters, water saving faucets and toilet flushing, etc. The FSR for subproject 1 estimated that the use of energy efficient features would reduce energy consumption by 50% or more compared to the business as usual scenario.

F. Cumulative Impacts

202. Cumulative impacts could arise from other projects in the vicinity particularly other buildings or infrastructure being constructed concurrently with the construction stage of the three subprojects. One possibility is ongoing construction activities on the Fangchenggang campus of the Guangxi College of Finance and Economics next to the campus of the Fangchenggang Poly Tech Vocational School in subproject 1, where there could be cumulative construction impacts during the construction stage of subproject 1. However it is likely that when construction activity in subproject 1 commences, construction activities on the Guangxi College of Finance and Economics campus would have been completed resulting in no cumulative impact. For subproject 2, Figure 10 above shows existing buildings to the west that might be remodeled to provide warehouses and logistics base. The domestic project proposal for subproject 2 also mentioned the construction of 2- and 3-storey standard size factory buildings and warehouses with a total floor area of 60,000 m^2 and a land take of 52,000 m^2 to the immediate south of the subproject site. The factory buildings and warehouses are for rental to SMEs and no program was provided on their construction. At this time no information is available on potential construction works from other projects that could overlap with the construction stage of the three subprojects.

203. Construction related cumulative impacts would be effectively minimized by adopting proper mitigation measures, including: (i) coordination between all project components and other projects in the area of influence in terms of construction schedule, possible access road and borrow/disposal sites and spoil sharing; (ii) contractors will develop material transport plan with consultation of local road management authority and local community; (iii) enforcement of good construction management to minimize dust, noise and waste generation; (iv) education of construction workers to minimize social disturbance and cultural conflict; (vi) provision of temporary access to local traffic to minimize construction traffic interruption; (vii) proper maintenance of the access roads and timely restoration/strengthening upon completion. With effective implementation of good construction management measures, these common construction-related cumulative impacts can be adequately mitigated to acceptable levels.

G. Indirect and Induced Impacts

204. The Tranche 1 subprojects support cross-border activity but are not anticipated to have significant indirect or induced environmental impacts. Subproject 4 (environment category FI), will involve specific screening to identify potential risks and environmental assessment requirements, including management of indirect and induced impacts.

VI. ANALYSIS OF ALTERNATIVES

A. No Project Alternative

205. The project has five outputs to improve regional cooperation and integration opportunities in border areas in Guangxi linking PRC and Viet Nam. Without the project, the border areas in Guangxi will continue to have difficulties in attracting investments for SMEs due to lack of infrastructure and services in the border economic zones, lack of new technologies such as e-commerce for accessing markets at and beyond the borders, inefficient cross-border financial transactions and settlement, and inability in customs inspection and clearance to handle the fast growing cross-border trade.

B. Alternatives Considered

206. The buildings and the facilities in the three subprojects are confined to within border areas, situated on an existing school campus (subproject 1), in an existing industrial park (subproject 2) and in an area zoned for its designated land use (subproject 6). The scope in the consideration of alternative sites was very much limited. The FSRs suggested different illumination intensities for different buildings, different types of light fixtures and toilet hardware for energy and water conservation, which would be considered during detailed design.

207. Subproject 6 considered an alternative location on the border trade service center site for the cold storage warehouse which uses liquid ammonia as coolant. The original location did not meet the buffer distances requirements (300 m downwind of the highest frequency summer wind direction and 150 m for other wind directions) between the cold storage warehouse and the nearest village. The alternative location met the above buffer distance requirement and was selected.

VII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Legislative Framework for Consultation, Participation and Information Disclosure

208. Meaningful participation and consultation during project planning, feasibility study, design and implementation is an important environment safeguards requirement. It can directly reflect the public's perceptions of environmental quality in the project's area of influence. Public participation and environmental information disclosure provisions are among the most significant changes introduced in the amended *Environmental Protection Law* (2014). The legislative framework also includes decrees on the preparation of EIA summaries for the purpose of public disclosure (see Table 2, item #25), information disclosure on construction project EIAs by government (Table 2, item #29), method for public participation in environmental protection (Table 2, item #31), and technical guidelines (for comment) for

public participation in EIAs (Table 2, item #57).

209. ADB Safeguard Policy Statement (2009) requires meaningful participation, consultation and information disclosure. ADB Public Communications Policy: Disclosure and Exchange of Information (2011) requires that the borrower shall provide safeguard information to affected people in a timely manner, in an accessible place, and in a form and language(s) understandable to them.

B. Information Disclosure

210. Information disclosure on the three subprojects involving civil works was conducted during public consultation for these three subprojects. Information disclosed included the scope of these subprojects, potential environmental impacts and mitigation measures during construction and operation. ADB's environmental safeguard requirements with emphasis on the implementation of EMP and GRM during subproject implementation. The project environmental information will also be disclosed by ADB as follows: (i) this IEE is available at www.adb.org; (ii) copies of the domestic EITs (in Chinese) for the subprojects are available on request from the PMO; and, (iii) environment progress will be reported in the quarterly project progress reports and the annual environmental monitoring reports which will be disclosed on ADB's project website (www.adb.org).

C. Consultation and Participation during Project Preparation

211. Public consultation in form of discussion forums on environmental matters were held on 15 August 2016 in the meeting room of Pingxiang Youyiguan Industrial Park Management Committee (for subproject 2) and Pingxiang Kafeng Village committee (for subproject 6), and on 17 August 2016 in the meeting room of Fangchenggang Jiangshan Land Acquisition and Resettlement Headquarter Office (for subproject 1). They were chaired by the Pingxiang City and Fangchenggang City PMOs respectively, and all supported by the PPTA environmental specialists. A total of 60 participants attended (Table 24) including representatives of government agencies, affected residents and other concerned stakeholders from the cities. Figure 16 shows photographs taken during these meetings.

Table 24: Communities, Enterprises, and Government Agencies Participated in the Public Consultation Discussion Forums

No.	Communities/Enterprises/Government Agencies	
1	Pingxiang City EPB	
2	Pingxing City Finance Office	
3	Development and Reform Bureau of Pingxiang City	
4	Land and Resource Bureau of Pingxiang City	
5	Xiashi Town Government	
6	Pingxiang Border Economic Co-operative Zone	
7	Pingxiang City urban investment company	
8	Pingxiang National Trade Company	
9	Fangchenggang Water Resource Bureau	
10	Land Acquisition and Resettlement Headquarter Office of Fangchenggang City	
11	PMO of Pingxiang City	
12	PMO of Fangchenggang City	
13	Pingxiang City	Nalou Village
14		Xiashi Community

No.	Communities/Enterprises/Government Agencies	
1	Pingxiang City EPB	
2	Pingxing City Finance Office	
3	Development and Reform Bureau of Pingxiang City	
4	Land and Resource Bureau of Pingxiang City	
5	Xiashi Town Government	
6	Pingxiang Border Economic Co-operative Zone	
7	Pingxiang City urban investment company	
8	Pingxiang National Trade Company	
9	Fangchenggang Water Resource Bureau	
10	Land Acquisition and Resettlement Headquarter Office of Fangchenggang City	
11	PMO of Pingxiang City	
12	PMO of Fangchenggang City	
13	Pingxiang City	Nalou Village
15		Bannan Village
16		Liuling Village
17		Kafeng Village
18	Fangchenggang City	Shamuwan Village
19		Fangchenggang Polytechnic School
20		Chongqing Engineering Design Institue
21		Gaungxi Caixia
22		No.2 Guangxi Construction Group

Figure 16: Discussion Forums for the Three Subprojects

Subproject 1 in Fangchenggang | Subproject 2 in Pingxiang | Subproject 6 in Pingxiang

Source: PPTA consultant

212. The officers from the local PMOs explained the content of the subprojects. The PPTA international specialist introduced the ADB safeguard requirements for IEE and EMP during construction and operation stages, basic specifications of the project, the findings on potential environmental impacts and mitigation measures, and project- specific GRM.

213. The main issues raised by the participants and the responses from local PMO and PPTA team are shown in Table 25. Basically, the concerns are related to dust, noise and wastewater impacts during construction and wastewater generated during operation.

Table 25: Main Issues and Responses

No	Subproject	Main Issue	Response
1	Subproject 2: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang BEZ	Dust impact on nearby villagers during construction period	The nearest sensitive point from project is residents in scattered households, about 180m to the east, and located at the upwind direction of construction site. During construction period, a series of measures such as covering, watering of unpaved areas and stockpiles, vehicle wheel washing, etc. will be undertaken to control dust impact.

No	Subproject	Main Issue	Response
2		Noise impact on nearby villagers during construction period	During construction period, noise impact on residents will be mitigated through the adoption of temporary noise barriers, construction machinery with low noise, construction time supervision, etc.
3		Wastewater discharge impact during project operation	Wastewater during project operation is mainly domestic sewage and canteen waste water, without production waste water. It will be discharged to municipal sewage pipe network after pretreatment, flow into Xiashi Town WWTP for treatment, and then be discharged after reaching the standard.
4	Subproject 6: Expansion of Pingxiang Border Trade Service Center	Dust impact on site during construction period	The nearest sensitive point from project is Kafeng Village, about 130m to the southeast. The civil construction will last for about 9 months, during construction period, the range and degree of dust impact will be reduced through a series of measures for construction dust and spoil transportation dust control, such as the incorporation of water sprinkling equipment, fence and barrier setting, and coverage of transportation vehicles in the contract.
5		Noise control during construction period	On construction site, noise impact will be controlled through measures such as selecting equipment with low noise, adopting sound insulation and absorption material to set up soundproofing shed, and strictly prohibiting construction operations with noise pollution during noontime (12：00-14：30) and nighttime (22：00-6：00), to ensure the normal life of nearby residents.
6	Subproject 1: Fangchenggang Polytechnic School Construction	Wastewater impact on nearby residents during construction period	The east side of project area is adjacent to Shiping Group in Shamuwan Village, about 500 m from the villagers' shrimp ponds; west side is about 30m from Fangchenggang Campus of Guangxi College of Finance and Economics. Design Institute has designed a rainwater collection system for construction site to collect the surface runoff containing sediment during rainy season, and discharge after the sedimentation tank processing, which can prevent sediment-contained waste water from flowing into nearby villages or shrimp ponds through drainage ditch or surface runoff, and affecting residents' living environment and water quality of shrimp ponds. Meanwhile, settling tank will be used for the treatment of construction waste water, and attention will be paid to water resource protection of nearby backup wells.
7		Dust control during construction period	The north side of project is adjacent to Class I highway from the port to Dongxing. During construction period, measures such as setting up fence and barriers, site water sprinkling, and covering transportation vehicles will be taken to prevent the impact of civil construction and transportation within the range of surrounding sensitive points.
8		Noise impact during construction period	Construction site is close to surrounding sensitive points, therefore night construction work will be avoided, and adopt noise mitigating measures to reduce the impact on residents. Meanwhile, construction period will be arranged properly and completed as soon as possible.

D. Future Plans for Public Participation

214. Meaningful consultation to safeguard the environment and local residents will continue before and throughout construction and operation phases consisting of information disclosure on project proponent and relevant government department web sites, posting of project information on community notice boards and discussion forums. The PMO and the PIUs will be responsible for organizing the public consultations, with the support of the External Environmental Monitor (EEM) on the project management consultant (PMC) team. The contractors will be required to communicate and consult with the communities in the project area of influence, especially those near the road alignments. Clearly visible public notice boards will be set at each work site to provide information on the purpose of the project activity, the duration of disturbance, the responsible entities on-site (contractors, IAs), and the project level Grievance Redress Mechanism (GRM). Contact information of all GRM entry points and the PMO complaint center hotline will be disclosed on the construction site information boards. Consultation will focus on public nuisances from construction and operation activities, such as noise, dust, traffic disturbance, as well as public concerns about the environment and resettlement.

215. Future consultation and participation will also include (i) involvement of affected people in discussion forums during inspection and monitoring of EMP implementation during construction and operation phases; (ii) participatory evaluation on the environmental and social-economic benefits and impacts in these forums; and (iii) consultation with the public after the project completion. The EMP provides plans for future public participation. The EMP for this project is included in Appendix 1 of this report.

VIII. GRIEVANCE REDRESS MECHANISM

216. Public consultation undertaken for the three tranche 1 subprojects with civil works as part of this IEE have discussed and addressed major community concerns. Continued public participation and consultation have been emphasized as a key component of successful program implementation. As a result of this public participation and safeguard assessment, major issues of grievance are not expected. However, unforeseen issues may occur. To settle such issues effectively, a transparent grievance redress mechanism (GRM) for lodging complaints and grievances has been defined for environment related issues.

217. The GRM has been designed to help achieve the following objectives: (i) open channel for effective communication, including the identification of new environmental issues of concern arising from the tranche 1 subprojects; (ii) prevent and mitigate any adverse environmental impacts on communities caused by construction and operation of the tranche 1 subprojects; (iii) improve mutual trust and respect and promote productive relationships with local communities; and (iv) build community acceptance of the program.

218. The PMO will establish a complaints center with a hotline for receiving both environmental and resettlement grievances. The details of the GRM are described in the EMP (Appendix 1), and were also explained to various stakeholders during discussion forums for the three tranche 1 subprojects with civil works. The GRM will be operational prior to commencement of construction works.

219. In addition to the program GRM, ADB's overall accountability mechanism (2012) applies.[19] This mechanism provides opportunities for people adversely affected by ADB-financed projects to express their grievances; seek solutions; and report alleged violations of ADB's operational policies and procedures, including safeguard policies. ADB's accountability mechanism comprises two separate, but related, functions: (i) consultation, led by ADB's special project facilitator, to assist people adversely affected by ADB-assisted projects in finding solutions to their problems; and (ii) providing a process through which those affected by projects can file requests for compliance review by ADB's Compliance Review Panel.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Objectives

220. An environmental management plan (EMP) has been prepared for tranche 1 of the program. It will provide the mechanism to implement mitigation measures and monitoring programs. The full EMP is presented in Appendix 1. It will also be included as an Appendix to the Facility Administration Manual (FAM) for the program. The EMP defines mitigation measures and describes the involved institutions and mechanisms to monitor and ensure compliance with environmental regulations and implementation of the mitigation measures. Such institutions and mechanisms will seek to ensure continuous improvement of environmental protection activities during preconstruction, construction, and operation of the tranche 1 subprojects in order to prevent, reduce, or mitigate adverse impacts. The EMP draws on the domestic EITs, this IEE, and the PPTA discussions and agreements with the relevant government agencies. The EMP will be reviewed and updated at the end of the detailed design in order to be consistent with the final detailed design, and will further be revised during implementation if determined that measures need to be amended or new measures are needed. The updated EMP will be disclosed on ADB's project website.

B. Organizational Structure for Environmental Management

221. **Executing Agency**. As EA, the Guangxi Foreign Loans Project Management Office (PMO) will be responsible for the overall implementation and compliance with loan assurances and the EMP (including Environmental Monitoring Plan). The PMO will have the overall responsibility to manage day-to-day activities and to supervise the implementation of environment mitigation and monitoring measures, coordinate the project GRM and report to ADB. PMO will (i) appoint at least one staff as the environmental focal point to coordinate and manage EMP implementation, (iii) engage the project management consultant (PMC) services, and (iii) undertake the procurement process for all tranche 1 subprojects. PMO will ensure that the environmental specification clauses listed in the EMP are incorporated into all bidding documents for the tranche 1 subprojects involving civil works. The PMO environmental focal point will (i) supervise contractors and their compliance with the EMP; (ii) conduct regular site inspections; (iii) act as local entry point for the project GRM; and (iv) submit environmental quality monitoring results provided by the IAs to the PMO for verification. PMO will prepare quarterly project progress reports and annual environment monitoring reports (EMR) and submit them to ADB.

222. **Implementing Agencies** (IA) for the three subprojects will consist of two project

[19] The revised accountability mechanism became effective on 24 May 2012.

implementation units (PIU). The Fangchenggang Poly Tech Vocational School will be the PIU for subproject 1. The Pingxiang Urban Construction and Investment Company will be the PIU for subprojects 2 and 6. They will implement subproject components, administer and monitor contractors and suppliers, and be responsible for construction supervision and quality control. Each PIU shall (i) contract the local Environmental Monitoring Station (EMS) to conduct environmental impact monitoring during the construction stage, and (ii) contract an external Environmental Supervision Engineer (ESE) to conduct independent verification of EMP implementation and environmental impact monitoring results. Each PIU shall have one staff as the environmental focal point to (i) supervise contractors and their compliance with the EMP, (ii) conduct regular site inspections, and (iii) submit environmental monitoring results provided by the EMS to the PMO, ESE and local Environmental Protection Bureaus (EPB) for verification and confirmation.

223. Under the PMC services contracted by the PMO, an **external environmental monitor** (EEM) who is an environmental specialist will be included to support the project. Terms of reference for this EEM are provided in the Facility Administration Manual. The EEM will:

(i) assess the project components' environmental readiness prior to implementation based on the readiness indicators defined in the EMP;
(ii) support PMO in updating the EMP including environmental monitoring plan as necessary to revise or incorporate additional environmental mitigation and monitoring measures, budget and institutional arrangements, that may be required based on the detailed design; submit to ADB for approval and disclosure; ensure compliance with the PRC's environmental laws and regulations, ADB's *Safeguard Policy Statement* (2009) and *Public Communications Policy* (2011);
(iii) if required, update the IEE and EMP reports for changes in the project during detailed design or project implementation (for example if there is a minor or major scope change) that would result in adverse environmental impacts not within the scope of the approved IEE/EMP;
(iv) assist PMO to establish a GRM;
(v) conduct regular EMP compliance assessments, undertake site visits as required, identify any environment-related implementation issues, and propose and oversee implementation of necessary corrective actions;
(vi) assist PMO to prepare quarterly project progress reports and annual EMRs for ADB;
(vii) provide training to PMO, PIUs and contractors on environmental laws, regulations and policies, SPS 2009, EMP implementation, and GRM in accordance with the training plan defined in the EMP; and
(viii) assist PMO and PIUs in conducting consultation meetings with relevant stakeholders as required, informing them of imminent construction works, updating them on the latest project development activities and GRM.

224. Each PIU will contract an independent **Environmental Supervision Engineer** (ESE) to verify environmental performance during construction and whether the implementation of EMP items complies with the plan. The ESE will review EMP implementation, monitoring activities and results, assess EMP implementation performance, visit the project sites and consult potentially affected people, discuss assessment with the PMO and the respective PIU; and suggest corrective actions. The ESE will prepare monthly reports for submission to the PIU which will be submitted to and reviewed by PMO during the preparation of the quarterly project progress reports for ADB and by the EEM during the preparation of the annual EMRs for ADB.

225. Construction **contractors** will be responsible for implementing the mitigation measures during construction under the supervision of the PIUs (through the ESE) and PMO. In their bids, contractors will be required to respond to the environmental specifications in the bidding documents. Each contractor will be required to assign a person responsible for environment, health and safety.

C. Inspection, Monitoring and Reporting

226. **Internal Environmental Monitoring**[20] will include monitoring of air quality, noise, water quality and other parameters described in the EMP during construction and operation of tranche 1 subprojects. These will be conducted by the local Environmental Monitoring Stations (EMS) contracted by the IAs. The monitoring results will be submitted to the IAs and PMO, and will be reported in the quarterly project progress reports and the annual EMRs prepared by the PMO and submitted to ADB.

227. **External Environmental Monitoring** will be periodically conducted by the local environmental authorities in the framework of their legal mandate to check compliance with applicable environmental regulations. They will be responsible for undertaking regular and random environmental monitoring and inspection activities before, during, and after construction as well as in the event of emergencies.

228. **External Compliance Monitoring/Auditing.** Independent evaluation (also known as compliance monitoring or compliance auditing) of EMP implementation will be undertaken by the ESE and EEM. PMO will report the EEM's independent evaluation to ADB on the program's adherence to the EMP, information on tranche 1 subproject implementation, environmental performance of the contractors, and environmental compliance through quarterly project progress reports and annual EMRs. The EEM will support PMO in developing the annual EMRs. The reports should confirm the tranche 1 subproject's compliance with the EMP and local legislation (including the PRC's EIA requirements), the results of independent evaluation (both contractor compliance with the EMP and the results of environmental monitoring by EMS), identify any environment related implementation issues and necessary corrective actions, and reflect these in a corrective action plan. Operation and performance of the program GRM, environmental institutional strengthening and training, and compliance with all covenants under the program will be included in the EMR.

229. Within 3 months after each tranche 1 subproject completion, or no later than 1 year with permission of the local EPBs, environmental acceptance monitoring and audit reports of each subproject completion shall be: (i) prepared by a licensed environmental monitoring station in accordance with the *Management Measures for Inspection and Acceptance of Environmental Protection at Construction Project Completion* (MEP Decree [2001] No. 13 and 2010 Amendment) (see Table 2, item #19) and *Management Procedures for the Supervision, Inspection and Environmental Acceptance of Construction Projects under the "Three Simultaneities"* (on trial) (MEP Announcement [2009] No. 150) (see Table 2, item #21); (ii) reviewed for approval by environmental authorities prior to the official commencement of tranche 1 subproject operation, and (iii) finally reported to ADB. The

[20] In this report, "environmental monitoring" refers to the activity of collecting environmental data either through *in-situ* measurements or through sampling followed by laboratory testing of samples.

environmental acceptance reports for completed tranche 1 subprojects will indicate the timing, extent, effectiveness of completed mitigation and of maintenance, and the needs for additional mitigation measures and monitoring during operation. These environmental acceptance reports will be provided to the EEM who is responsible for preparing an environmental completion report and inputs for the Project Completion Report (PCR) for ADB.

X. CONCLUSION AND RECOMMENDATION

A. Expected Project Benefits

230. The project will have positive benefits in achieving better regional cooperation and investment between the PRC and Viet Nam by improving the skills of Chinese and Vietnamese workers and SMEs, improving the hardware and software for cross-border trade and commerce, and strengthening the support on SME development in the border areas of GZAR.

B. Adverse Impacts and Mitigation Measures

231. During the construction of the buildings and facilities in subprojects 1, 2 and 6, potential impacts would include dust, noise, wastewater and solid waste generated on the construction sites and by the construction workers. This IEE has identified appropriate mitigation measures to reduce such potential impacts to acceptable levels. These measures have been included in the EMP for implementation during the construction stage.

232. Land take for the three subprojects is relatively small, about 16.3 ha in total. The sites for subprojects 1, 2 and 6 are on an existing campus, in an industrial park, and in an area zoned for financial and commerce land use, respectively. Assessment undertaken indicates that these sites have been disturbed by human activities and are either void of vegetation (such as the school campus in subproject 1) or dominated by common and planted trees, shrubs and grass (such as subprojects 2 and 6). The sites do not impinge on protected areas or critical habitats and no protected flora and fauna has been recorded on these sites. Ecological value of the subproject sites is deemed to be low.

233. Wastewater generated during operation of these facilities will either be treated by wastewater treatment systems on site (such as subproject 1) or conveyed to wastewater treatment plants for treatment (such as subprojects 2 and 6). Solid waste generated during operation will be collected by local sanitation bureaus for proper disposal.

234. Operation of the training facility in Subproject 2 related to training on reprocessing and finishing of small home appliances and red wood furniture would involve sanding, polishing and paint spray present some occupational hazards. Such activities would generate air pollutants such as VOC and fine dust particulates affecting the health and safety of the teachers and students inside the training facility. Training on use, handling and storage of any potentially hazardous materials and PPE such as safety glasses, goggles, respirators and ear plugs will be provided to the teachers and students. The design of the facility will include activated carbon absorbents and fabric filters to collect VOC and fine dust particulates respectively so that these pollutants would not be emitted into the ambient atmosphere.

235. The cold storage facility in subproject 6 will use liquid ammonia as coolant. If accidentally leaked, the liquid ammonia would evaporate into ammonia gas, which is an irritant and toxic at high concentration. Environmental risk assessment using numerical modeling of ammonia dispersion upon accidental leakage indicate that the impact would be very much localized (within a distance of 26 m) and short term (20 minutes). The EMP has specified mitigation measures on the design of the liquid ammonia storage room, emergency response planning, and provision of training and PPE for workers. .

236. Energy and water saving features for the facilities have been recommended in the FSRs for adoption during detailed design. Based on climate risk and vulnerability assessment, increased drainage design and slope stabilization standards would increase climate resilience in the event of more extreme rainfall events. A range of design measures to increase energy efficiency have been specified which would reduce solar absorption during heatwaves and increase flood retention capacity.

237. Based on information gathered and assessments performed by the domestic environmental design institutes, it is concluded that environmental impacts during the construction and operational stages of the three subprojects would be acceptable and in compliance with PRC regulations and standards and ADB's SPS (2009) if the EMP is implemented and monitored effectively. The EMP defines mitigation measures and monitoring requirements for the design, construction, and operational stages of the three subprojects. Appropriate environmental safeguards for the planned works are proposed and form part of a comprehensive set of project management documents. The EMP also includes a list of environmental contract clauses for inclusion into all tender documents and works contracts, thus binding the contractors legally in the implementation of environmental mitigation measures during construction.

238. For the subproject with FI, an ESMS has been prepared for effective implementation of environmental safeguard measures by the FI, Bank of Communications.

239. An environmental assessment and review framework (EARF) has also been prepared as a guidance document for the Guangxi Zhuang Autonomous Region (GZAR) government to prepare relevant environmental safeguard documents to meet Asian Development Bank's (ADB) environmental safeguard requirements for subprojects in subsequent tranches.

C. Risks and Assurances

240. The project has no unusual technical risks and conventional engineering designs with proven reliability and performance will be adopted for all the subprojects. From an environment safeguards point of view, the main risk relates to the failure of the PMO and the PIUs to monitor environmental impacts and implement the EMP during construction and operational stages. This risk will be mitigated by (i) providing training in environmental management under the project; (ii) appointing qualified project management consultant, (iii) following appropriate project implementation monitoring and mitigation arrangements, (iv) ADB conducting regular project review missions; and (v) through compliance with project assurances covenanted in the loan and project agreement with ADB.

241. General and specific environmental assurances are required to ensure that the project can achieve its envisaged outcome. The following sections define the assurances that will

be included in the project agreement. The EMP also includes a list of environmental contract clauses for inclusion into all tender documents and works contracts, binding contractors legally to implementation of environmental mitigation and monitoring measures during construction.

242. **General environmental assurances**. The Guangxi Foreign Loans Project Management Office (GPMO) as the EA will ensure and cause the PIU to ensure that the preparation, design, construction, implementation, operation, maintenance, monitoring and decommissioning of the project and project facilities comply with (i) all applicable laws and regulations of the Government on environment, health, and safety; (ii) the environmental safeguards (i.e. principles and requirements set forth in ADB's Safeguard Policy Statement (2009); and (iii) all measures and requirements set forth in the domestic environmental impact tables (EIT), this IEE and environmental management plan (EMP) for the project; and any corrective or preventive actions (a) set forth in a safeguards monitoring report, or (b) which are subsequently agreed between ADB and GPMO will cause the PIUs to prepare, at the outset of component implementation, detailed internal monitoring programs to be implemented by the contractors during construction and operation phases, and to incorporate such mitigation and monitoring measures into the design of components, relevant bidding documents and construction contracts. Throughout project implementation, GPMO and the PIUs will review any changes to the project design that may potentially cause negative environmental impacts, and in consultation with ADB, update IEE and EMP by revising mitigation measures as necessary to assure full environmental compliance.

243. GPMO and the PIUs will appoint environmental focal points for monitoring EMP implementation and making appropriate use of external independent entities for environmental monitoring and compliance monitoring. GZAR Government will ensure that the PIUs are obliged to provide annual environmental monitoring reports throughout the construction period to GPMO, which will in turn prepare and submit to ADB annual environmental monitoring reports in a format acceptable to ADB.

244. **Specific environmental assurances**. GPMO will ensure that within 60 days from the loan effectiveness, GPMO establishes the project grievance redress mechanism relating to safeguards in line with the EMP and Resettlement Plan and establishes a task force functioning effectively to: (a) review and document eligible complaints of project stakeholders; (b) proactively address grievances; (c) agree with the complainants the chosen mechanism for redress; and (d) prepare periodic reports to summarize the number of complaints received and resolved, and final outcomes of the grievances and chosen actions and make these reports available to ADB on request. Eligible complaints include those related to the project, any of the service providers, any person responsible for carrying out the project, complaints on misuse of funds and other irregularities and grievances due to any safeguard issues, including resettlement, environment, and gender.

245. GPMO will ensure that the PIU for the Cross-border Labor Cooperation Demonstration Park (subproject 2) will (i) provide personal protective equipment (PPE) such as safety glasses, goggles, respirators and ear plugs to the teachers and students undergoing training inside the training facility; and (ii) handle all hazardous solid waste generated during training appropriately with proper collection and temporary storage on site, and regularly collected by a company licensed for chemical waste collection, transport and treatment.

246. GPMO and the PIU for Expansion of Pingxiang Border Trade Service Center (subproject 6)

will ensure that (i) operation of the center will commence only after the commissioning of either the wastewater treatment station on the neighboring Pingxiang Border Trade Logistics Center or the Kafeng Wastewater Treatment Plant, whichever is sooner for treatment wastewater generated from this subproject; (ii) the design for liquid ammonia storage in the cold storage facility conforms to applicable standards; (iii) PPE is provided to workers working in the liquid ammonia storage room; and (iv) an emergency response plan is prepared; and (v) training on the use of liquid ammonia, handing of liquid ammonia drums and emergency response in the event of accidental leakage of liquid ammonia is provided to workers.

247. GPMO will ensure that the FI complies with the safeguard requirements in the ESMS.

248. GZAR Government and the PIUs shall ensure that detailed design of the infrastructure subprojects (1, 2 and 6) address the recommendations of the climate change risk and vulnerability analysis.

D. Overall Conclusion

249. The domestic EITs and this IEE conclude that all identified environmental impacts can be mitigated to acceptable levels if the measures defined in the EMP and assurances are carefully implemented and monitored. The project is feasible from an environmental safeguards point of view and will contribute to improving regional cooperation and investment between the PRC and Viet Nam

Appendix 1

ENVIRONMENTAL MANAGEMENT PLAN

September 2016

People's Republic of China: Guangxi Regional Cooperation and Integration Promotion Investment Program

Prepared by the Government of Guangxi Zhuang Autonomous Region for the Asian Development Bank.

A. Introduction

1. This Environmental Management Plan (EMP) is developed for Tranche 1 of the Guangxi Regional Cooperation and Integration Promotion Investment Program Multitranche Financing Facility (MFF) (the project). The EMP identifies the potential environmental impacts and defines mitigation measures and monitoring requirements for the design, construction, and operational stages of the three subprojects (numbers 1, 2 and 6)[1] in Tranche 1 that will involve civil works. It also defines the institutional arrangements and mechanisms, the roles and responsibilities of different institutions, procedures and budgets, capacity building and training for implementation of the environmental aspects of Tranche 1 of the MFF program. The EMP seeks to ensure environmental protection activities during preconstruction, construction, and operation are implemented effectively in order to prevent, reduce, or mitigate adverse environmental impacts and risks. The EMP draws on the findings of the project initial environmental examination (IEE) report; the domestic feasibility study reports (FSR) and environmental impact tables (EIT) for the three subprojects; the project preparation technical assistance (PPTA) reports, and discussions and agreements with relevant government agencies and the Asian Development Bank (ADB).

2. This EMP is based on proposed project designs described in the FSRs as of May 2016 for subproject 1, July 2106 for subproject 2 and April 2016 for subproject 6. Detailed engineering designs are yet to be finalized and may require subsequent impact assessment and/or revisions to this EMP. The Guangxi Zhuang Autonomous Region (GZAR) Government will provide the detailed designs to ADB for review to determine if the EMP requires revision. The final EMP will be disclosed on the ADB public website (www.adb.org) and included in the facility administration manual (FAM). The final EMP will also be included as a separate annex in all bidding and contract documents for Tranche 1 subprojects. The contractors will be informed of their obligations to implement the EMP, and to include EMP implementation costs in their bids for subprojects 1, 2 and 6 works. The EMP defines the overarching Grievance Redress Mechanism (GRM) for the program, however, entry points will also be provided at a subproject level. All Project Implementing Entities (PIEs) will be made aware of the GRM requirements.

3. This EMP consists of six components: (i) institutional arrangements and environmental responsibility, (ii) environmental mitigation measures, (iii) environmental monitoring, (iv) institutional strengthening and training, (v) public consultation, and (vi) grievance redress mechanism (GRM). Environmental monitoring consists of two types of monitoring: (i) environmental monitoring in terms of environmental data collection and analyses for assessing the extent and severity of impact and (ii) compliance monitoring (or audit) by independent entities for verifying EMP implementation. The last section of this EMP contains a list of environmental contract clauses for inclusion into all bidding documents and works contracts for the three subprojects for environmental protection during construction.

4. In addition to this EMP, an Environmental and Social Management System (ESMS) has been prepared to set out the specific safeguard requirements for the financial intermediary (FI), Bank of Communications (BoCOM) who are the PIE for subproject 4 which will provide finance for small and medium sized enterprises in Fangchenggang, Chongzuo and Baise to promote cross-border trade and investment. Projects that would be classified as Environment category A are excluded from funding. An Environment and Assessment Review Framework (EARF) has been prepared to set out the environmental safeguard requirements for preparation of

[1] **Subproject 1**: Construction of Fangchenggang Training Center for Chinese and Vietnamese Workers and SMEs. **Subproject 2**: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone. **Subproject 6**: Expansion of Pingxiang Border Trade Service Center.

subsequent tranches. The Facility Administration Manual sets out the project management consulting services allocated to support the implementation of the Tranche 1 program and the preparation of Tranche 2.

B. Institutional Arrangements and Responsibilities for EMP Implementation

5. **Executing agency**. The **GZAR** will be the executing agency (EA) responsible for overall implementation and compliance with loan assurances and the EMP.

6. **Project management office**. The EA has established the **Guangxi Foreign Loans Project Management Office** (广西国外贷款项目管理办公室) (GPMO)**,** who will be responsible, on behalf of the EA, for the day-to-day management of the project. The GPMO will have the overall responsibility of supervising the implementation of environment mitigation and monitoring measures, coordinate the project GRM and report to ADB. GPMO shall (i) appoint one person on its staff roster as the environmental focal point to coordinate and manage EMP implementation, (iii) engage the project management consultant (PMC) services, and (iii) supervise the procurement process. The GPMO environmental focal point with support of the PMC environment specialists shall (i) provide overall co-ordination and support on environmental aspects of all Tranche 1 subprojects; (ii) support GPMO with preparation of subsequent tranches in compliance with the EARF; (iii) support Bank of Communications, Nanning (BoCOM) with safeguard screening and classification of initial subproject components, and monitor assessment and reporting, particularly for environment Category B subproject components in compliance with the ESMS; (iv) supervise contractors and their compliance with the EMP; (v) conduct regular site inspections; (vi) act as GPMO entry point for the project GRM; (vii) submit environmental monitoring data provided by the IAs to EEM; and support GPMO with preparation of quarterly project progress reports and annual environment monitoring reports (EMR) and submit them to ADB.

7. **Implementing agency.** Implementing Agencies (IA) for the three subprojects with infrastructure components are the following **project implementing entities** (PIE): The Fangchenggang Poly Tech Vocational School (防城港理工职业学校) for subproject 1, and the Pingxiang Urban Construction and Investment Company (凭祥市城市建设投资有限公司) for subprojects 2 and 6. The PIEs will implement subproject components, administer and monitor contractors and suppliers, and be responsible for construction supervision and quality control. To ensure that the contractors comply with the EMP provisions, the PIEs with the help and technical support of a Tendering Agent and the External Environmental Monitor (EEM) under the PMC services, shall prepare and provide the following specification clauses for incorporation into the bidding procedures: (i) a list of environmental management and monitoring requirements to be budgeted by the bidders in their proposals; (ii) environmental clauses for contractual terms and conditions; and (iii) major items in the IEE, and the full EMP. Each PIE shall (i) contract the local Environmental Monitoring Station (EMS) to conduct environmental quality monitoring during the construction stage, and (ii) contract an external Environmental Supervision Engineer (ESE) to conduct independent compliance audit and verification of EMP implementation during the construction stage of the subproject. Each PIE shall appoint one person on its staff as environmental focal point to (i) supervise contractors and their compliance with the EMP, (ii) conduct regular site inspections, and (iii) submit environmental quality monitoring data provided by the EMS to the PMO and local Environmental Protection Bureau (EPB).

8. **Construction contractors** for the three subprojects shall be responsible for implementing the mitigation measures during construction under the supervision of the PIEs

(through the ESE) and GPMO. In their bids, contractors shall be required to respond to the environmental management and monitoring requirements defined in the EMP. Each contractor shall be required to assign a person responsible for environment, health and safety.

9. **External environmental monitor (EEM).** An EEM will be recruited to support the implementation of the three infrastructure subprojects. Terms of reference for the EEM are provided in the FAM. The EEM will:

- assess the project's environmental readiness prior to implementation based on the readiness indicators defined in Table EMP-3 in the EMP;
- support GPMO in updating the EMP including environmental monitoring plan as necessary to revise or incorporate additional environmental mitigation and monitoring measures, budget, institutional arrangements, etc., that may be required based on the detailed design; submit to ADB for approval and disclosure; ensure compliance with the PRC's environmental laws and regulations, ADB's Safeguard Policy Statement (2009) and Public Communications Policy (2011);
- if required, update the IEE and EMP reports for changes in the subprojects during detailed design or subproject implementation (for example if there is a minor or major scope change) that would result in adverse environmental impacts not within the scope of the approved IEE/EMP;
- assist GPMO to establish a GRM;
- conduct EMP compliance audit, undertake site visits as required, identify any environment-related implementation issues, and propose and oversee implementation of necessary corrective actions;
- assist GPMO to prepare quarterly project progress reports and annual EMRs for submission to ADB;
- provide training to GPMO, PIEs and contractors on environmental laws, regulations and policies, SPS 2009, EMP implementation, and GRM in accordance with the training plan defined in the EMP (Table EMP-7); and
- assist GPMO and PIEs in conducting consultation meetings with relevant stakeholders as required, informing them of imminent construction works, updating them on the latest subproject development activities, GRM.

10. **Environmental supervision engineer (ESE)** 环境监理. Each PIE shall contract an independent ESE to verify environmental performance during construction and whether the implementation of EMP items complies with the plan. The ESE will review EMP implementation and monitoring activities and results, assess EMP implementation performance, visit the project sites and consult potentially affected people, discuss assessment with the GPMO and the respective PIE; and suggest corrective actions. The ESE will prepare monthly reports for submission to the PIE which will be submitted to and reviewed by GPMO during the preparation of the quarterly project progress reports for ADB and by the EEM during the preparation of the annual EMRs for ADB.

11. Table EMP-1 outlines the overall environmental responsibilities.

C. Summary of Potential Impacts and Mitigation Measures

12. Potential environmental issues and impacts during pre-construction, construction and operation phases for the three subprojects, and corresponding mitigation measures, are summarized in Table EMP-2, separated into those that are common to all three subprojects and those that are subproject specific. There are two types of mitigation measures:

- Measures that will permanently become part of the infrastructure such as engineering measures for energy efficiency, green building features and barrier-free accessibility, etc. should be included within the main civil work contract costs, and are not double-counted as part of the EMP costs.
- Temporary measures during the construction stage (e.g. dust suppression by watering, use of quiet / low noise powered mechanical equipment (PME), flocculants used to facilitate sedimentation of suspended solids in construction site runoff, etc.) will need to be included in the tender documents to ensure that contractors budget these items in their bids.

Table EMP-1: Environmental Responsibility

Responsible Entity	Project Stage and Environmental Responsibility				
	Project Preparation	**Engineering Detailed Design**	**Tendering & Pre-construction**	**Construction**	**Operation**
GZAR Government	The Executing Agency (**EA**) for the project responsible for overall implementation and compliance with loan assurances and the EMP.				
GPMO (Guangxi Foreign Loans Project Management Office)	Established by the EA to be responsible for the day-to-day management of the project. Has overall responsibility delegated by the EA for supervising the implementation of environmental mitigation measures, coordinating the project level GRM and reporting to ADB				
	1. Engage LDIs to prepare FSR, EIT and RP	1. Engage LDIs 2. Update IEE/EMP if needed 3. Review updated EMP 4. Confirm that mitigation measures have been included in engineering detailed design	1. Appoint one environmental focal point on staff 2. Incorporate IEE/EMP clauses in tender documents and contracts 3. Manage the procurement process 4. Establish the project complaint center with hot-line 5. Engage EEM as part of the PMC services	1. Supervise EMP implementation to ensure effectiveness 2. Operate the project complaint center and coordinate the project environment GRM records and reporting. 3. Prepare quarterly project progress reports and annual EMRs and submit them to ADB 4. Conduct information disclosure and public consultation 5. Inspect implementation of mitigation measures.	1. Instruct the PIEs on environmental management requirements 2. Prepare quarterly project progress reports and annual EMRs until a PCR is issued
1. Fangchenggang Poly Tech Vocational School 2. Pingxiang Urban Construction and Investment Company	The Implementing Agency (**IA**) for the subprojects are the project implementing entities (**PIEs**) who will implement subproject components, administer and monitor contractors and suppliers, and take responsibility for construction supervision and quality control. Will ensure that the EMP is implemented proactively and will respond to any adverse impact beyond those foreseen in the IEE and ensure that if there are any changes in scope the IEE/EMP will be updated, as needed. Will also attend to requests from relevant agencies and ADB regarding the mitigation measures and environmental monitoring program.				
			1. Incorporate IEE/EMP clauses in tender documents and contracts 2. Appoint an environmental focal point on staff 3. Engage local EMS for environmental monitoring 4. Engage ESE for independent compliance audit and verification	1. Supervise contractors and ensure compliance with the EMP 2. Coordinate construction supervision and quality control 3. Coordinate environmental monitoring according to the environmental monitoring program in the approved EMP 4. Act as a local entry point for the project GRM, collate records and report monthly to GPMO on GRM 5. Submit monthly monitoring results to GPMO and local EPBs	1. Coordinate environmental monitoring according to the approved EMP until a PCR is issued 2. Ensure proper operation of subproject facilities according to design standards
Local design institutes (LDIs)	1. Prepare subproject FSRs, EITs, RPs 2. Conduct public consultation	1. Incorporate mitigation measures defined in the approved EITs and this EMP into engineering detailed designs 2. Update the EMP in cooperation with the EEM 3. Incorporate agreed climate adaptation measures into engineering detailed designs..			
Local EPBs	1. Review and approve the subproject EITs			1. Review subproject environmental monitoring results 2. Conduct mandated inspection and monitoring	

Responsible Entity	Project Stage and Environmental Responsibility				
	Project Preparation	Engineering Detailed Design	Tendering & Pre-construction	Construction	Operation
				3. Conduct the "Three Simultaneity[2]" acceptance inspections on completion of the subprojects	
PPTA consultant	1. Provide technical assistance 2. Review EITs and other relevant documents 3. Prepare IEE report and EMP				
EEM		1. Review updated EMP, confirm that mitigation measures have been included in engineering detailed design	1. Review bidding documents to ensure that the IEE/EMP clauses are incorporated 2. Confirm project's readiness in respect of environmental management.	1. Advise on mitigation measures 2. Provide technical support to GPMO, PIEs and contractors for environmental management 3. Conduct environmental training 4. Conduct EMP compliance audit 5. Support GPMO in preparing quarterly project progress reports and annual EMRs. 6. Review domestic environmental inspection acceptance reports 7. Provide environmental input to the PCR.	1. Conduct EMP compliance audit 2. Support PMO in instructing PIEs on environmental management requirements 3. Support PMO in preparing quarterly project progress reports and annual EMRs until a PCR is issued 4. Coordinate environmental monitoring until a PCR is issued
Contractors			1. Ensure sufficient funding and human resources for proper and timely implementation of required mitigation and monitoring measures in the EMP throughout the construction phase	1. Appoint an environment, health and safety (EHS) officer to oversee EMP implementation related to environment, occupational health and safety on construction site 2. Ensure health and safety 3. Implement mitigation measures 4. Act as a local entry point for the project GRM	
Local EMS 环境监测站				1. Undertake environmental monitoring according to the environmental monitoring program in the approved EMP (*contracted by PIEs*) 2. Report monitoring data to ESE, PIEs and GPMO	1. Undertake environmental quality monitoring until a PCR is issued (*contracted by PIEs*) 2. Submit monitoring results to the PIEs
ESE 环境监理				1. Conduct independent verification of subproject's environment performance and compliance with the EMP (*contracted by PIEs*) 2. Review monthly monitoring data submitted by EMS, and conduct	

[2] The "Three Simultaneities" requires the design, construction, and operation of pollution control and treatment facilities to occur simultaneously with the project design, construction, and operation.

Responsible Entity	Project Stage and Environmental Responsibility				
	Project Preparation	Engineering Detailed Design	Tendering & Pre-construction	Construction	Operation
				compliance checking against applicable environmental standards and report to EEM. 3. Provide advice to contractors to resolve on-site environmental problems when monitoring data shows non-compliance and any environmental complaints raised. 4. Submit monthly compliance auditing results to PMO and PIEs	
ADB	1. Review and approve the IEE and EMP and disclose on ADB website	1. Approve updated IEE/EMP if appropriate and disclose on ADB website	1. Review bidding documents 2. Review proposed candidates for EEM to ensure suitably qualified. 3. Confirm project's readiness	1. Review quarterly project progress reports, annual EMRs and PCR 2. Undertake review missions 3. Advise on compliance issues, as required 4. Review and disclose annual EMRs on ADB website.	1. Review and approve EMRs and disclose on ADB website 2. Undertake project completion review mission and prepare PCR for approval by Board and disclosure on ADB website.

Notes:
ADB = Asian Development Bank; **EA** = executing agency; **EEM** = external environmental monitor; **EHS** = environment, health & safety; **EIT** = environmental impact table; **EMP** = environmental management plan; **EMR** = environmental monitoring report; **EMS** = Environmental Monitoring Station; **EPB** = Environmental Protection Bureau; **ESE** = environmental supervision engineer; **FSR** = feasibility study report; **GPMO** = Guangxi project management office; **GRM** = grievance redress mechanism; **GZAR** =Guangxi Zhuang Autonomous Region; **IA** = implementing agency; **IEE** = initial environmental examination **LDI** = local design institute; **PCR** = project completion report; **PIE** = project implementing entity; **PMC** = project management consultant; **PPTA** = project preparation technical assistance; **RP** = resettlement plan

Table EMP-2: Summary of Potential Impacts and Mitigation Measures

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
A: Mitigation measures applicable to all three subprojects						
A.1: Detailed Design Stage						
Green building design	Materials and fixtures, carbon emission	Efficient use of resources and energy	● Technical design of buildings and facilities shall include barrier-free universal access ● Technical design of buildings and facilities shall include energy saving features in terms of building envelope/roofing materials, electrical system and automation, water heating, air conditioning and ventilation, and lighting, etc. as recommended in the FSRs ● Technical design of buildings and facilities shall consider other "green building" features besides energy saving.	LDI	GPMO	Included in design contract
Slope stability	Climate change	Extreme rainfall causing landslide	● A high design standard shall be adopted for slope stabilisation design to improve climate resilience.	LDI	GPMO	Included in design contract
A.2: Pre-construction Stage						
Institutional strengthening	--	Lack of environmental management capacities within PMO and PIEs	● Appoint qualified staff as the environmental focal point to oversee EMP implementation.	GPMO, PIEs	ADB	GPMO, PIEs
			● Contract EEM within PMC services ● Conduct environment management training.	GPMO	ADB	GPMO
	--	Lack of environmental monitoring and supervision capability and qualification	● Contract local EMS (环境监测站) to conduct environmental quality monitoring during construction and operation. ● Appoint an environmental supervision engineer (ESE,环境监理) responsible for the environmental supervision of contractors and environmental audit of construction sites.	PIEs	GPMO	PIEs
Grievance redress mechanism	--	Establish a system for receiving and resolving complaints	● Establish a project-specific grievance redress mechanism (GRM) including a complaint hotline. ● Brief and provide training to other GRM access points (PIEs, contractors).	GPMO	ADB	GPMO, PMC service
EMP Update	-	-	● Review mitigation measures defined in this EMP, update as required to reflect detailed design, disclose updated EMP on project website.	GPMO, EEM	ADB	GPMO, PMC
Tender and contract documents	-	Environmental contract clauses-	● Put the environmental contract clauses listed in Section J of this EMP into all civil works tender documents and contracts and ensure adequate cost provision.	GPMO, Ias, Tendering Agent	EEM, ADB	Included in tendering agency contract
						Estimated cost for Design and Pre-construction stage: Included in detailed design and contract tender fees
A.3: Construction Stage						
Construction site good practice	Air quality	Dust (TSP) during construction	● Spray water at least twice each day on unpaved areas and exposed dust-prone stockpiles except on rainy days. ● Store dust-prone materials in areas with shelters on four sides and on top. If such materials have to be stored in open area, cover with strong tarpaulin. ● Control vehicle speed to ≤ 8 km/h in unpaved areas. Post the speed limit sign in these areas. ● Pave construction site exits with gravel or asphalt. ● Install wheel washing equipment or conduct wheel washing manually at each construction site exit to prevent trucks from carrying muddy or dusty substances onto public roads. ● Vehicles with an open load-carrying case, which transport potentially dust-producing materials, shall have proper fitting sides and tail boards. Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with a strong tarpaulin. ● Provide personal protective equipment (PPE) such as goggles, gloves and respirators to construction workers doing interior fit-out to minimize skin exposure to chemicals and inhalation of VOC. ● Regularly maintain construction vehicles and machinery to minimize exhaust emissions from these sources. ● Unauthorized burning of construction and demolition waste material and refuse shall be subject to penalties for the Contractor, and withholding of payment.	Contractor	PIEs, ESE, EEM	$84,000 (contractor bid)
	Noise and vibration	Noise from PME and vehicles	● No construction works shall be conducted between 22:00 to 06:00 hours. Piling works shall also be prohibited between 12:00 to 14:30 hours. ● Carry out consultation with local communities to discuss/agree the timing of noisy construction activities. ● During construction, the contractor shall: – ensure regular equipment repair and maintenance to keep them in good working condition to	Contractor	PIEs, ESE, EEM	$90,000 (contractor bid)

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			minimize noise – deploy low noise machinery or the equipment with sound insulation – erect temporary noise barriers or hoardings around noisy equipment to shield the noise from equipment – provide the construction workers with suitable hearing protection (ear muffs) when working near noisy machinery such as during piling – forbid the use of horns unless absolutely necessary, minimize the use of whistles			
	Water quality	Construction site runoff and wastewater discharge	● Collect runoff from construction sites with drainage ditches to prevent runoff containing muddy water from polluting nearby roads, land and water bodies. ● Install and operate oily-water separators and sedimentation tanks on construction sites to treat process water and muddy runoff with high concentrations of total petroleum hydrocarbon and suspended solids. If necessary, use flocculants such as polyacryl amide to facilitate sedimentation. ● Provide portable toilets and small package wastewater treatment plants and/or septic tanks on construction sites for the workers. If there are nearby public sewers, install interim storage tanks and pipelines to convey wastewater to public sewers. ● Store fuels, oil, and other hazardous materials on construction sites within secured areas on impermeable surfaces protected by bunds and provided with cleanup kits. ● Clean up any chemical spills into drains and water bodies according to PRC norms and codes within 24 hours of the occurrence, with contaminated soils and water treated according to PRC norms and codes. Records must be handed over without delay to the GPMO and local EPB.	Contractor	PIEs, ESE, EEM	$105,000 (contractor bid)
	Solid waste	Construction site refuse and C&D waste	● Maximize the re-use of C&D wastes on the project. ● Store all refuse and C&D waste generated on construction sites in designated areas and remove them from these locations for disposal or reuse regularly.	Contractor	PIEs, ESE, EEM	$45,000 (contractor bid)
	Ecology	Destruction of vegetation and wildlife	● Construction workers are prohibited from capturing any wildlife during construction. ● Where a tree has to be removed or an area of grassland disturbed, replant trees and re-vegetate the area after construction. ● Tree planting shall use local species with local provenance. Planting of exotic or invasive species shall be prohibited.	Contractor	PIEs, ESE, EEM	None
	Physical cultural resources	Destruction of buried cultural relics	● Comply with PRC's *Cultural Relics Protection Law* and *Cultural Relics Protection Law Implementation Ordinance* if such relics are discovered, stop work immediately and notify the local cultural authority, adopt measures to protect the site.	Contractor	PIEs, ESE, EEM	None
	Overall disturbance to communities	Excessive disturbance to communities due to prolonged construction times	● Identify and adhere to strict schedule for completion of civil works and avoid prolonged construction and disturbance. ● Keep communities informed of construction activities, in particular those that may result in disruption of access, noisy or dust-generating activities that are likely to result in significant disturbance. Ensure communities are aware of Grievance Redress Mechanism entry points.	Contractor	PIEs, ESE, EEM	Covered in above costs
Health and Safety	Occupational health and safety	Environment, health & safety officer	● Appoint at least one environment, health and safety (EHS) officer to manage occupational health and safety risks on construction sites by applying the following measures.	Contractor	PIEs, ESE, EEM	(contractor staff)
		Construction site sanitation	● Provide adequate and functional systems for sanitary conditions, toilet facilities, waste management with waste separation, labor dormitories and cooking facilities. ● Effectively clean and disinfect the site. During site formation, spray with phenolated water for disinfection. Disinfect toilets and refuse bins and ensure timely removal of solid waste. ● Exterminate rodents on site at least once every 3 months, and exterminate mosquitoes and flies at least twice each year. ● Provide public toilets in accordance with the requirements of labor management and sanitation departments in the living areas on construction site, and appoint designated staff responsible for cleaning and disinfection ● Discharge construction site domestic wastewater into the municipal sewer system or treated on-site using a portable system.	Contractor	PIEs, ESE, EEM	Included in water quality above (contractor bid)

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
		Occupational safety	● Provide personal protective equipment (safety hats and shoes, high visibility vests and safety belt and harness for above ground works) to all construction workers and strictly enforce all workers to put on the PPE. ● Provide safety goggles, gloves and respiratory masks to workers doing doing interior fit-out works. ● Provide ear plugs to workers operating and working near noisy PME.	Contractor	PIEs, ESE, EEM	$60,000 (contractor bid)
		Food safety	● Inspect and supervise food hygiene in canteens on site regularly. Canteen workers must have valid health permits. ● If food poisoning is discovered, implement effective control measures immediately to prevent it from spreading.	Contractor	PIEs, ESE, EEM	None
		Disease prevention and safety awareness	● Construction workers must have physical examination before starting work on site. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. From the second year onwards, conduct physical examination on 20% of the workers every year. ● Establish health clinic at location where workers are concentrated, which should be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents. ● Provide induction and training by local health departments on prevention and management of communicable diseases.	Contractor	PIEs, ESE, EEM	$10,000 (contractor bid)
	Community health and safety	Temporary traffic management	● Prepare a traffic control and operation plan together with the local traffic police prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.	Contractor, local traffic police	PIEs, ESE, EEM	None
		Information disclosure	● Erect construction billboards, which include construction contents, schedule, responsible person and complaint phone number, at the entry to each construction site and construction staging area. ● Inform residents and businesses in advance of the road improvement activities, given the dates and duration of expected disruption and make aware of the project GRM. ● Place clear signs at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations etc. and raising awareness on safety issues.	Contractor	PIEs, ESE, EEM	None
		Access to construction sites	● Make all sites secure, and discourage access by members of the public through appropriate fencing, signage and/or security personnel, as appropriate.	Contractor	PIEs, ESE, EEM	None
		Utility services interruptions	● Assess construction locations in advance and identify potential for disruption to services and risks before starting construction. Any damage or hindrance/disadvantage to local businesses caused by the premature removal or insufficient replacement of public utilities is subject to full compensation, at the full liability of the contractor who caused the problem. ● If temporary disruption is unavoidable, develop a plan in collaboration with relevant local authorities such as power company, water supply company and communication company to minimize the disruption and communicate the dates and duration in advance to affected persons.	Contractor, local utility service providers	PIEs, ESE, EEM	None
Grievance redress mechanism	Social & environmental	Handling and resolving complaints on contractors	● Appoint a GRM coordinator ● Disclose GRM to affected people before construction begins at the main entrance to each construction site. ● Maintain and update a Complaint Register to document all complaints.	Contractor, PIEs	PMO, EEM	Contractor and PIE budget
						Estimated cost for the Construction Stage: $394,000
Zone						
B: Subproject 1: Construction of Fangchenggang Training Center for Chinese and Vietnamese Workers and SMEs						
B.1: Detailed Design Stage						
Drainage	Climate change	Extreme rainfall	Technical design of the drainage system for the Fangchenggang Poly Tech Vocational School shall adopt an 8% increase over the current standard as an adaptation measure for extreme rainfall due to climate change.	LDI	GPMO, FPTVS	included in design contract
B2: Construction Stage						
Construction site good practice	Noise	Noise from PME affecting students in classes, dormitories and on campus	● Deploy low noise machinery with noise insulation and install temporary noise barriers around noisy PME ● Avoid noisy construction activities during examination periods	Contractor	PIE (FPTVS), ESE, EEM	Included in item A.3 above (contractor bid)
C: Subproject 2: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone						

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
C.1: Detailed Design Stage						
Air emission from training facility	Air quality	Emission of VOC and fine dust particulates from training facilities due to sanding, polishing and paint spraying.	Technical design of the training center shall include activated carbon absorbent for VOC removal and fabric filter for removal of dust composed of fine particulate matters.	LDI	GPMO, PUCIC	Included in design contract
Drainage	Climate change	Extreme rainfall	Technical design of the drainage system shall adopt a 10% increase over the national standard as an adaptation measure for extreme rainfall due to climate change.	LDI	GPMO, PUCIC	Included in design contract
C.2: Operation Stage						
Health & safety	Air quality and noise inside training facility	VOC, fine dust particulates and noise during sanding, polishing and paint spraying	Provided PPE such as goggles, respirators and ear plugs for health and safety protection to all teachers and students from VOC, fine particulate matters and noise during training	PUCIC	GPMO, PUCIC	Included in PIE operation budget
D: Subproject 6: Expansion of Pingxiang Border Trade Service Center						
D.1: Detailed Design Stage						
Drainage	Climate change	Extreme rainfall	Technical design of the drainage system shall adopt a 10% increase over the national standard as an adaptation measure for extreme rainfall due to climate change.	LDI	GPMO, PUCIC	Included in design contract
Cold storage facility	Liquid ammonia used as coolant	Storage and containment of liquid ammonia	Technical design of the liquid ammonia storage room for the cold storage warehouse must comply with the requirements in PRC's GB 18597-2001 *Standard Pollution Control on Hazardous Waste Storage*.	LDI	GPMO, PUCIC	Included in design contract
D.2: Operation Stage						
Cold storage facility	--	Liquid ammonia storage	● The maximum allowable quantity of liquid ammonia stored on site shall not exceed 5 tons at any given time. ● Prepare an emergency response plan for liquid ammonia leakage. ● Place PPE such as goggles and respirators in conspicuous locations outside the liquid ammonia storage room for use by all workers inside the room. ● Train workers on the handling of liquid ammonia drums, the use of the cold storage facility, and emergency response should liquid ammonia leakage occur.	PUCIC	GPMO	None

Key: **ADB** = Asian Development Bank; **EEM** = external environmental monitor; **EHS** = environment, health & safety; **EIT** = environmental impact table 环境影响报告表; **EMP** = environmental management plan; **EMS** = Environmental Monitoring Station 环境监测站; **EPB** = Environmental Protection Bureau; **ESE** = Environmental supervision engineer 环境监理; **FPCVS** = Fangchenggang Poly Tech Vocational School 防城港理工职业学校; **FSR** = feasibility study report; **GPMO** = Guangxi project management office; **GRM** = grievance redress mechanism; **IA** = implementing agency; **IEE** = initial environmental examination; **LDI** = local design institute; **PIE** = project implementing entity; **PMC** = project management consultant; **PME** = powered mechanical equipment; **PPE** = personal protective equipment; **PRC** = :People's Republic of China; **PUCIC** = Pingxiang Urban Construction and Investment Company 凭祥市城市建设投资有限公司; **SS** = suspended solid; **TSP** = total suspended particulates; **VOC** = volatile organic compound

13. The mitigation measures defined in the EMP will be (i) checked and where necessary updated by the design institutes and the EMP subsequently updated; (ii) incorporated into tender documents (where appropriate), construction contracts, and operational management plans; and (iii) implemented by contractors and PIEs under supervision of GPMO. The effectiveness of these measures will be evaluated based on the results of the environmental monitoring conducted by local EMS, and through EMP compliance audits conducted by the ESE and EEM.

D. Monitoring and Reporting

14. Three types of project monitoring will be conducted under the EMP. [3]

i. Project readiness monitoring. To be conducted by the EEM or GPMO environmental focal point (under the support of EEM).

ii. Environmental quality monitoring. To be conducted by local EMS (contracted by the PIEs) involving the collection and analyses of air quality and noise data at designated monitoring locations to assess compliance with applicable environmental quality and emission standards during construction.

iii. Compliance monitoring or auditing. To be conducted by the ESE (contracted by the PIEs) and EEM to verify EMP compliance during project implementation. The EEM will function as an external monitor/auditor for ADB.

15. ADB will oversee project compliance on the basis of the quarterly project progress reports and annual environmental monitoring reports provided by GPMO and site visits (generally 1-2 times/year). Monitoring and reporting arrangements for the three subprojects are described below.

16. **Project readiness monitoring.** Before construction, the EEM will assess the subprojects' readiness on environmental management based on a set of indicators (Table EMP-3) and report it to ADB and PMO. This assessment will demonstrate that environmental commitments are being carried out and environmental management systems are in place before construction starts, or suggest corrective actions to ensure that all requirements are met.

Table EMP-3: Project Readiness Assessment Indicators

Indicator	Criteria	Assessment
EMP update	• EMP was updated after technical detail design & approved by ADB	Yes No
Compliance with loan covenants	• The borrower complies with loan covenants related to project design and environmental management planning	Yes No
Public involvement effectiveness	• Meaningful consultation completed	Yes No
	• GRM established with entry points	Yes No
Environmental supervision and monitoring in place	• External Environmental Monitor (EEM) is in place	Yes No
	• Staff environmental focal points appointed by GPMO and PIEs	Yes No
	• Environmental supervision engineers (ESE) contracted by PIEs	Yes No

[3] In addition to project-specific monitoring, local EPBs will conduct independent ambient and/or enforcement monitoring as per national requirements. This is separate to, and not funded by, the project.

Indicator	Criteria	Assessment
	• Environment monitoring stations (EMS) contracted by PIEs	Yes No
Bidding documents and contracts with environmental safeguards	• Bidding documents and contracts incorporating the environmental activities and safeguards listed as loan assurances	Yes No
	• Bidding documents and contracts incorporating the environmental contract clauses listed in Section J of the EMP	Yes No
EMP financial support	• The required funds, if applicable, have been set aside for EMP implementation	Yes No

17. **Environmental monitoring.** Table EMP-4 shows the environmental monitoring program designed for the three subprojects, defining the scope, location, parameter, duration and frequency, and responsible agencies, for monitoring during the construction. No environmental monitoring is deemed necessary for the operational stage. Environmental monitoring will include monitoring of air quality and noise during construction. These will be conducted by local EMSs (contracted by the PIEs). The selection of monitoring locations is based on distances from the subproject sites, number of households and populations affected, and the extent of sensitivity to air and noise impacts (e.g. residential household, school).

18. The monitoring results will be compared with relevant PRC performance standards (Table EMP-5). Non-compliance with these standards will be highlighted in the EMRs. Monitoring results will be submitted by the EMSs to the PIEs, ESE and local EPBs on a monthly basis. In turn, the PIEs will submit the data to GPMO and EEM also on a monthly basis. GPMO will then submit to ADB in the annual EMRs (prepared with the support of the EEM–Table EMP-6).

Table EMP-4: Environmental Monitoring Program

Monitoring Location	Item	Monitoring Parameter	Monitoring Frequency & Duration	Implementing Entity	Supervising Entity
Subproject 1: Construction of Fangchenggang Training Center for Chinese and Vietnamese Workers and SMEs					***Estimated cost: $17,000***
Construction stage					
I: On the campus of the Fangchenggang Poly Tech Vocational School （防城港市理工职业学校）, at façade of building nearest to the following buildings during construction: 1. Training building #3 （#3 实训楼） 2. Student dormitories #3 and #4 (#3、#4学生宿舍) 3. Comprehensive information building (信息综合楼) 4. Sports management and auxiliary office building (体育管理及生活附属用房） II: Guangxi College of Finance and Economics （广西财经学院）: 1. East boundary of the school campus	Air quality	TSP	2 consecutive days (24-hr) per month until a PCR is issued	Local EMS	FPTVS, ESE
	Noise	L_{Aeq}	2 consecutive days (day time only) per month until a PCR is issued		
Subproject 2: Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone					***Estimated Cost: $30,000***
Construction stage					
1. Bannan Village 板南	Air quality	TSP	2 consecutive days (24-hr) per month until a PCR is issued	Local EMS	PUCIC, ESE
	Noise	L_{Aeq}	2 consecutive days (day time only) per month until a PCR is issued		
Subproject 6: Expansion of Pingxiang Border Trade Service Center					***Estimated cost : $10,000***
Construction stage					
1. Kafeng Village 卡凤 2. Busha Village 布沙	Air quality	TSP	2 consecutive days (24-hr) per month until a PCR is issued	Local EMS	PUCIC, ESE
	Noise	L_{Aeq}	2 consecutive days (day time only) per month until a PCR is issued		
					Total estimated cost: $57,000

Notes: **EMS** = Environmental Monitoring Station 环境监测站; **ESE** = environmental supervision engineer 环境监理; **L_{Aeq}** = A-weight equivalent sound pressure level； **FPTVS** = Faangchenggang Poly Tech Vocational School 防城港市理工职业学校; **GPMO** = Guangxi project management office; **PCR** = project completion report; **PUCIC** = Pingxiang Urban Construction and Investment Company 凭祥市城市建设投资有限公司; **TSP** = total suspended particulates;

Table EMP-5: Monitoring Indicators and Applicable PRC Standards[4]

Phase	Indicator	Standard
Construction	TSP	Class II ***Ambient Air Quality Standard*** (GB 3095-2012)
	Noise limits of PME at boundary of construction site	***Emission Standard of Environmental Noise for Boundary of Construction Site*** (GB 12523-2011)
Note: **PME** = powered mechanical equipment		

19. **Independent compliance monitoring.** Independent evaluation of EMP implementation will be undertaken by the ESE and EEM. The budget for the ESEs is estimated at $615,000. The EEM will be recruited as an individual consultant ($100,000) and will cover the three subprojects. GPMO will report the EEM's independent evaluation to ADB on the subprojects' adherence to the EMP, information on subproject implementation, environmental performance of the contractors, and environmental compliance through quarterly project progress reports and annual EMRs (Table EMP-6). The EEM will visit the project sites twice a year and support GPMO in developing the annual EMRs. The reports should confirm the subprojects' compliance with the EMP and local legislation (including the PRC's environmental assessment and implementation requirements), the results of independent evaluation (both contractor compliance with the EMP and the results of environmental monitoring by local EMSs), identify any environment related implementation issues and necessary corrective actions, and reflect these in a corrective action plan. Operation and performance of the project GRM, environmental institutional strengthening and training, public consultation, compliance with all covenants under the project and site photographs will also be included in the report. A template for the Environmental Monitoring Report is included in the Facility Administration Manual.

20. **Monitoring by ADB.** Besides reviewing the annual EMRs from GPMO and BoCOM, ADB missions will inspect the project progress and implementation on site at least once a year. For environmental issues, inspections will focus mainly on (i) environmental monitoring data; (ii) the implementation status of subproject performance indicators specified in the loan documents for the environment, environmental compliance, implementation of the EMP, and environmental institutional strengthening and training; (iii) the environmental performance of contractors, ESEs, EEM, PIEs and GPMO; and (iv) operation and performance of the project GRM and ongoing information disclosure and public consultation. The performance of the contractors in respect of environmental compliance will be recorded and will be considered in the next bid evaluations. ADB also prepares the final Project Completion Report.

21. **Environmental acceptance monitoring and reporting.** Following the PRC's ***Management Measures for Inspection and Acceptance of Environmental Protection at Construction Project Completion*** (MEP Decree [2001] No. 13 and 2010 amendment), within three months after the completion of each subproject, an environmental acceptance monitoring and audit report for the subproject shall be prepared by a licensed environmental monitoring institute. The report will be reviewed and approved by the local EPB, and then reported to ADB (Table EMP-6). The environmental acceptance reports for the completed subprojects will indicate the timing, extent, effectiveness of completed mitigation and maintenance, and the needs for additional mitigation measures and monitoring during operation. The GPMO with support of the EEM will prepare a draft Project Completion Report which includes an environment chapter.

[4] The project applies PRC standards. A comparison of PRC standards with internationally accepted standards (as defined in the World Bank's Environment Health and Safety Guidelines) was conducted for the IEE. The comparison confirmed that PRC standards are either internationally accepted, or have comparable standard limits with most of the international standards.

Table EMP-6: Reporting Plan

Reports		From	To	Frequency
Construction Phase				
Internal progress reports by contractors	Internal project progress report by construction contractors, including monitoring results	Contractors	GPMO, PIEs	Monthly
Environmental monitoring and compliance monitoring reports	Environmental monitoring report	EMSs	Local EPBs, PIEs, GPMO, ESE, EEM	Monthly
	Environment monitoring reports (EMR)	GPMO (with EEM support)	ADB	Annually
	Environment monitoring reports (EMR)	BoCOM	ADB	Annually
Acceptance report	Environmental acceptance monitoring and audit report	Licensed institute	Local EPBs	Once; within 3 months of completion of physical works
Operational Phase				
Environmental monitoring	Quarterly project progress reports (until a PCR is issued	Local EMSs	Local EPBs, PIEs, GPMO, EEM	Quarterly
	Environment monitoring reports (until a PCR is issued)	GPMO (with EEM support)	ADB	Annually
Project completion report	Draft project completion report including environmental chapter	GPMO (with EEM support)	ADB	On completion
	Final project completion report	ADB	ADB	On completion

Notes: **ADB** = Asian Development Bank; **EEM** = external environmental monitor; **EMR** = environmental monitoring report; **EMS** = Environmental Monitoring Station; **EPB** = Environmental Protection Bureau; **ESE** = environmental supervision engineer; **GPMO** = Guangxi project management office; **PCR** = project completion report; **PIE** = project implementing entity.

E. Institutional Capacity Building and Training

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

23. **Institutional strengthening**. The capacities of GPMO and PIEs to coordinate environmental management will be strengthened through a set of measures:

(i) PMC will support GPMO with appointment of an international environment consultant (2 months) and a national consultant (10 months) to provide support on environmental management for all subprojects and preparation of Tranche 2.
(ii) The appointment of qualified staff within the GPMO and each PIE as environmental focal points in charge of EMP coordination, implementation and site inspections including GRM.
(iii) The commissioning of an independent ESE by each PIE to provide independent monitoring and verification of EMP implementation.
(iv) The appointment of EEM (an independent consultant) under the PMC service to guide GPMO and PIEs in implementing the EMP and ensuring compliance with ADB's Safeguard Policy Statement (SPS 2009).

24. **Training**. GPMO, PIEs and contractors will receive training in EMP implementation, supervision, and reporting, and on the GRM (**Table EMP-7**). Training will be facilitated by the EEM with support of experts under the PMC services, as needed. The ESMS and EARF also identify institutional strengthening and training to support effective implementation of requirements.

Table EMP-7: Training Program

Training	Attendees	Contents	Times	Period (days)	No. of persons	Cost ($/person /day)	Total Cost
EMP adjustment and implementation	GPMO, PIEs, contractors	Development and adjustment of the EMP, roles and responsibilities, monitoring, supervision and reporting procedures, review of experience (after 12 months)	Twice - Once prior to, and once after the first year of subproject implementation	2	20	100	$8,000
Grievance Redress Mechanism	GPMO, PIEs, contractors, local EPBs	Roles and responsibilities, procedures, review of experience (after 12 months)	Twice - Once prior to, and once after the first year of subproject implementation	1	15	100	$3,000
Environmental protection	GPMO, PIEs, contractors	Pollution control on construction sites (air, noise, wastewater, solid waste), use of PPE during construction and operation, occupational health and safety	Once (during subproject implementation)	2	15	100	$3,000
Environmental monitoring	GPMO, PIEs, contractors	Monitoring methods, data collection and processing, reporting systems	Once (at beginning of subproject construction)	1	10	100	$1,000
						Total estimated cost:	**$15,000**

Notes: **EPB** = Environmental Protection Bureau; **GPMO** = Guangxi project management office; **PIE** = project implementing entity; PPE = personal protective equipment.

25. **Capacity building**. In addition to training for EMP implementation, the project will provide consulting services and training to assist and train the staff of GPMO and PIEs in project management, environmental management, land acquisition and resettlement, procurement, as well as external resettlement and environmental monitoring. In addition to the training, specified in the plan, $30,000 will be included in the budget for each tranche for wildlife trafficking enforcement capacity development.

F. Consultation, Participation and Information Disclosure

26. **Consultation during project preparation**. Chapter VII of the IEE describes the public participation and consultation carried out during project preparation.

27. **Future public consultation plan**. Plans for public involvement during construction and operation stages were developed during project preparation. These include public participation in (i) monitoring impacts and mitigation measures during the construction and operation stages; (ii) evaluating environmental and economic benefits and social impacts; and (iii) interviewing the public after the subproject is completed. These plans will include several types of public involvement, including site visits, interviews, workshops and investigation of specific issues (Table EMP-8).

Table EMP-8: Public Consultation Plan

Organizer	Format	No. of Times	Subject	Attendees	Budget
Construction Stage					
GPMO	Public consultation & site visit	4 times: 1 time before construction commences and 1 time each year during construction	Adjusting of mitigation measures, if necessary; construction impact; safety near construction sites; comments and suggestions	Residents adjacent to subprojects, representatives of local communities	$5,000
GPMO	Expert workshop / press conference	As needed based on public consultation	Comments / suggestions on mitigation measures, public opinions	Experts of various sectors, media	$2,000
Operational Stage					
GPMO, PIEs	Public consultation and site visits	Once in the first year	Effectiveness of mitigation measures, impacts of operation, comments and suggestions	Residents adjacent to subproject sites, social sectors	$1,500
GPMO, PIEs	Expert workshop or press conference	As needed based on public consultation	Comments and suggestions on operational impacts, public opinions	Experts of various sectors, media	$1,500
				Total budget:	**$10,000**
Notes: **GPMO** =Guangxi project management office; **PIE** = project implementing entity.					

G. Grievance Redress Mechanism

28. A Grievance Redress Mechanism (GRM) will be established as part of this EMP to receive and manage any public concerns or issues which may arise due to the subprojects. The GRM comprises: (i) a set of clear procedures developed by GPMO to receive, record, and address any concerns which are raised; (ii) specific contact details for individuals at the GPMO, PIEs and the contractors, and (iii) the local EPBs.

29. All contractors and work staff will be briefed by the GPMO on the GRM. Contractors and workers will be instructed to be courteous to local residents and, in the event they are approached by the general public with an issue, to immediately halt their work and report the issue to the foreman. The foreman will immediately report the issue to the PIEs or GPMO for action.

30. There are multiple entry points to the GRM, including face-to-face meetings, written complaints, hotline number and telephone conversations, anonymous drop-boxes for written comments, and/or e-mail. All concerns received will be treated confidentially and professionally. The identity of individuals will not be circulated among subproject agencies or staff and will only be shared with senior staff, and then only when there is clear justification. In the construction period and the initial operational period covered by loan covenants, GPMO will report on GRM to ADB, including complaints and their resolution in the quarterly project progress reports and annual environmental monitoring reports up to the project completion report.

31. Basic steps for resolving complaints are as follows and illustrated in Figure EMP-1.

Step 1: For environmental problems during the construction and operational stages, the affected person (AP) can register his/her complaint directly with the contractors or with the GPMO complaint center via its hotline. A joint hotline for resettlement and environment issues will be established within GPMO. Complaints related to land acquisition and resettlement issues will be directed to the GPMO and relevant agencies in accordance with the RP. Contractors are required to set up a complaint hotline and designate a person in charge of handling complaints, and advertise the hotline number at the main entrance to each construction site, together with the hotline number of the GPMO complaint center. The contractors are required to maintain and update a Complaint Register to document all complaints. The contractors are also required to respond to the complainant in writing within 7 calendar days on their proposed solution and how it will be implemented. If the problem is resolved and the complainant is satisfied with the solution, this can be recorded by the GPMO complaint center and follow-up should be carried out during a next project site visit by the EEM. The contractors are required to report complaints received, handled, resolved and unresolved to the GPMO complaint center immediately, and to the IAs and GPMO monthly (through progress reporting).

Step 2: If no appropriate solution can be found during step 1, the contractor has the obligation to forward the complaint to the GPMO complaint center, the PIEs and local EPBs. The PIEs and local EPBs shall immediately notify GPMO upon receiving the complaint. For an oral complaint, proper written records shall be made. Once a complaint is registered and put on file, the GPMO complaints center will immediately notify ADB and others concerned to discuss acceptable solutions. The GPMO complaint center will assess the eligibility of the complaint, identify the solution and provide a clear reply for the complainant within 14 calendar days. The EEM will assist the GPMO complaint center in addressing the complaint, and follow-up with the AP. The GPMO complaint center will also inform the ADB project team and submit all relevant documents. Meanwhile, the GPMO complaint center will convey the complaint/grievance and suggested solution to the contractors, PIEs, and/or facility operator in a timely manner. The contractors during construction and the facility operator during operation will implement the agreed redress solution and report the outcome to the GPMO complaint center within fifteen (15) working days.

Step 3: In case no solution can be identified by the GPMO complaint center, or the complainant is not satisfied with the proposed solution, the GPMO complaint center will organize, within 14 calendar days, a multi-stakeholder hearing (meeting) involving all relevant stakeholders (including the complainant, PIEs, contractors, facility operator, local EPB, and GPMO). The hearing shall identify a solution acceptable to all, and formulate an action plan.

32. The tracking and documenting of grievance resolutions by GPMO will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) regular updating of the GRM database by the GPMO environmental focal point; (iii) processes for informing stakeholders about the status of a case; and (iv) procedures to retrieve data for reporting purposes, including the periodic reports to the ADB.

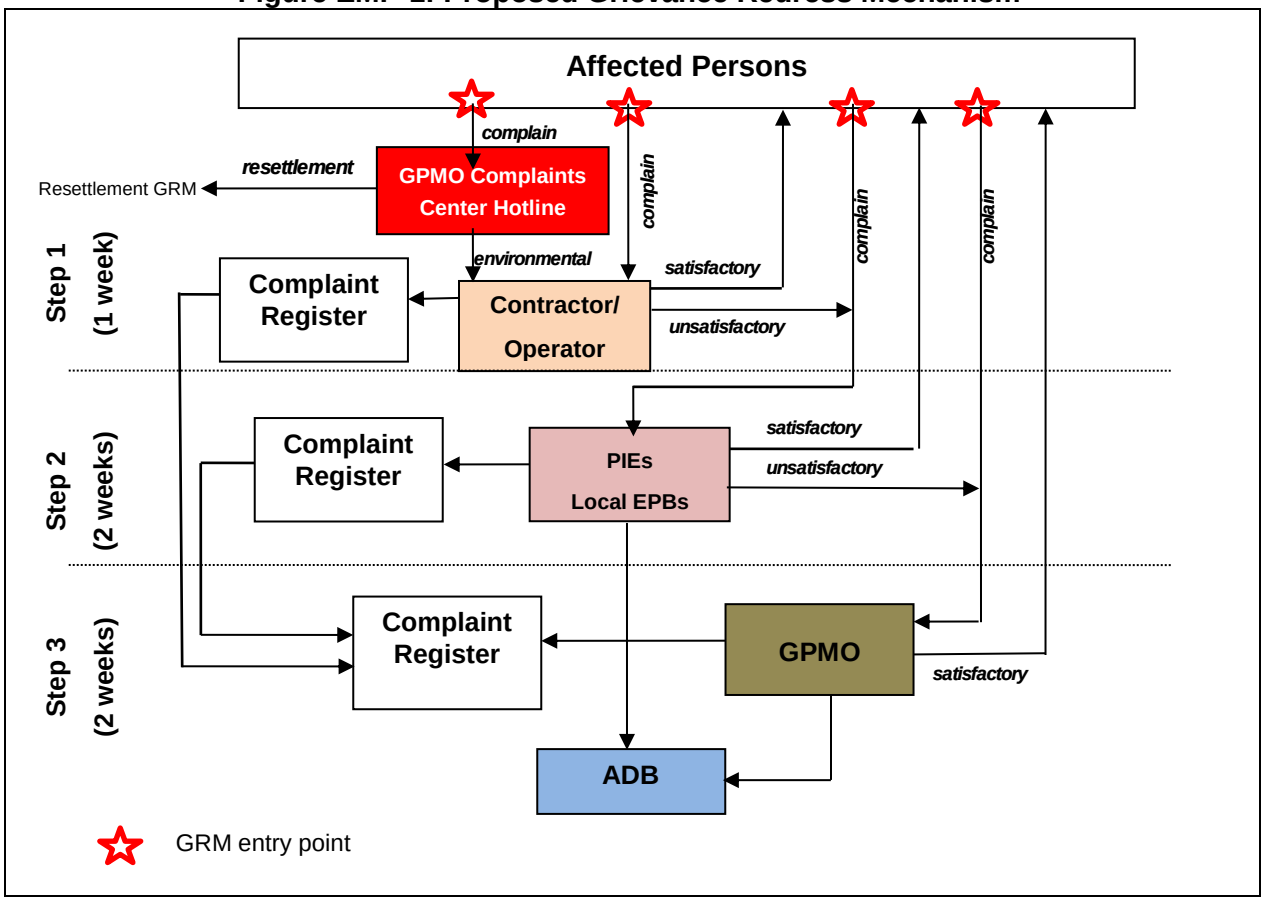
33. At any time, an AP may contact ADB (East Asia Department) directly, including the ADB Resident Mission in the PRC.

34. If the above steps are unsuccessful, persons who are, or may in the future be, adversely affected by the project may submit complaints to ADB's Accountability Mechanism. The

Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted projects can voice, and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make a good faith effort to solve their problems by working with the concerned ADB operations department. Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.[5]

[5] See: http://compliance.adb.org/

Figure EMP-1: Proposed Grievance Redress Mechanism



H. Cost Estimates

35. The total cost for EMP implementation comprises: (i) mitigation measures (Table EMP-2), (ii) environmental monitoring by local EMSs (Table EMP-4), (iii) supervision of EMP implementation by ESE, (iv) public consultation (Table EMP-7), (v) training (Table EMP-8), and (vi) the compliance monitoring, training and reporting by EEM. The total cost is summarized in Table EMP-9 and is $1,321,000. Of this total the mitigation cost of $394,000 has been included in the civil works costs in the contractor bids for implementing environmental mitigation measures for air quality, noise, water quality and solid waste on construction sites. The budget allocation is indicated in the notes accompanying Table EMP-9.

Table EMP-9: Estimated Budget for Environmental Management Plan Implementation

EMP Item	Estimated Cost	
	EA or PIE Funded	ADB Funded
Environment Training[1]		$15,000
Wildlife Trafficking Training[1]		$30,000
Mitigation measures[2]	$394,000	
Environmental monitoring by local EMS[3]		$57,000
Environmental supervision by ESE[4]	$615,000	
Environmental management/co-ordination by Environment Specialist specialist (2 months international@25000) and 10 months national@5000) [5]		$100,000
Wildlife trafficking specialist (5 months@5000)[5]		$25,000
External compliance monitoring by EEM (10 months@5000)[5]		$50,000
Public consultation[6]		$10,000
Subtotal:	$1,009,000.00	$287,000.00
Total:	**$1,296,000.00**	

Notes: ADB = Asian Development Bank; **EA** = executing agency; **EEM** = external environmental monitor; **EMP** = environmental management plan; **EMS** = Environmental Monitoring Station; **ESE** = environmental supervision engineer; **PIE** = project implementing entity.

[1] Included in PMC training budget
[2] Included in civil works contract - contractors' bids
[3] Included in Project Management Consultant Services
[4] Included in Supervision Engineer Costs paid by PIEs
[5] Included in Project Management Consultant Services
[6] Included in Project Management Consultant Services

36. Excluded from the budget are (i) infrastructure costs which relate to environment and public health but which are already included in the project direct costs and (ii) remuneration for the GPMO environment focal point and consulting packages for the non-structural components, (covered elsewhere in the project budget).

37. Contractors will bear the costs for all mitigation measures during construction, including those specified in the tender and contract documents as well as those to mitigate unforeseen impacts due to their construction activities. The PIEs will bear the costs related to mitigation measures during operation (e.g. provision of PPE to students and teachers during training in subproject 2).

I. Mechanisms for Feedback and Adjustment

38. The EMP is a living document. The need to update and adjust the EMP will be reviewed when there are design changes, changes in construction methods and program, unfavorable environmental monitoring results, monitoring locations are no longer appropriate or mitigation measures are inadequate or ineffective. Based on environmental monitoring and reporting systems in place, GPMO (with the support of the EEM) shall assess whether further mitigation measures are required as corrective action, or improvement in environmental management practices are required. GPMO will inform ADB promptly on any changes to the project and needed adjustments to the EMP. The updated EMP will be submitted to ADB for review and approval, and will be disclosed on the ADB project website, if required.

J. Environmental Contract Clauses for Inclusion into Tender Documents and Civil Works Contracts

39. The following contract clauses for safeguarding the environment during construction shall be incorporated into all the tender documents and works contracts.

1. Construction time:

1.1 There shall be no night time (between 22:00 and 06:00 hours) construction. Piling works shall also be prohibited between 12:00 and 14:30 hours.

2. Protection of air quality

2.1 Watering of unpaved areas and exposed dust-prone stockpiles shall be undertaken at least two times each day except on rainy days

2.2 Dust-prone materials shall be stored in areas with shelters on four sides and on top. If such materials have to be stored in open area, they shall be covered with strong tarpaulin.

2.3 Vehicle speed in unpaved areas shall be limited to ≤ 8 km/h. Speed limit sign shall be posted in these areas.

2.4 Construction site exits shall be paved with gravel or asphalt

2.5 Wheel washing equipment shall be installed or wheel washing shall be conducted manually at each exit of the works area and asphalt/concrete mixing station to prevent trucks from carrying muddy or dusty substance onto public roads.

2.6 Vehicles with an open load-carrying case, which transport potentially dust-producing materials, shall have proper fitting sides and tail boards. Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with s strong tarpaulin.

2.7 Construction vehicles and machinery shall be regularly maintained to minimize exhaust emissions from these sources.

2.8 Unauthorized burning of construction and demolition waste material and refuse shall be subject to penalties for the Contractor, and withholding of payment.

3. Protection of the acoustic environment

3.1 Machinery and equipment shall be maintained and repaired regularly and properly to keep them in good working condition and to minimize noise.

3.2 Low noise machinery or equipment with sound insulation shall be deployed.

3.3 Temporary noise barriers or hoardings shall be erected around the equipment to shield the noise from equipment.

3.4 Suitable hearing protection (such as ear muffs) shall be provided to construction workers when working near noisy machinery such as during piling.

3.5 The use of horns is forbidden unless absolutely necessary. The use of whistles shall be minimized.

3.6 Noisy activities affecting other site users such as students in training classes or

taking examinations shall be avoided and the deployment of low noise machinery and temporary noise barrier shall be adopted.

4. Protection of water quality

4.1 Runoff from construction sites shall be collected with drainage ditches to prevent runoff containing muddy water from polluting nearby roads, land and water bodies.

4.2 Oily-water separators and sedimentation tanks shall be installed and operated on construction sites to treat process water and muddy runoff with high concentrations of total petroleum hydrocarbon and suspended solids. If necessary, flocculants such as polyacryl amide (PAM) shall be used to facilitate sedimentation.

4.3 Portable toilets and small package wastewater treatment plants and/or septic tanks shall be provided on construction sites for the workers. If there are nearby public sewers, interim storage tanks and pipelines shall be installed to convey wastewater to public sewers.

4.4 Fuels, oil, and other hazardous materials on construction sites shall be stored within secured areas on impermeable surfaces protected by bunds and provided with cleanup kits.

4.5 Chemical spills into drains and water bodies shall be promptly cleaned up according to PRC norms and codes within 24 hours of the occurrence, with contaminated soils and water treated according to PRC norms and codes. Records must be handed over without delay to the GPMO and local EPB.

5. Protection of biological resources and wildlife

5.1 Construction workers are prohibited from capturing any wildlife during construction.

5.2 Where a tree has to be removed or an area of grassland disturbed, trees shall be replanted and the area revegetated after construction.

5.3 Tree planting shall use species of local provenance. Planting of exotic or invasive species shall be prohibited.

6. Solid waste management

6.1 The re-use of C&D wastes on the project shall be maximized.

6.2 Store all refuse and C&D waste generated on construction sites shall be stored in designated areas and regularly removed from these locations for disposal or reuse.

7. Construction site sanitation

7.1 Adequate and functional systems for sanitary conditions, toilet facilities, waste management, labor dormitories and cooking facilities shall be provided.

7.2 The site shall be effectively cleaned and disinfected. During site formation, the site shall be sprayed with phenolated water for disinfection. Toilets and refuse bins shall be disinfected and timely removal of solid waste shall be ensured.

7.3 Rodents on site shall be exterminated at least once every 3 months. Mosquitoes and flies shall be exterminated at least twice each year.

7.4 Public toilets shall be provided in accordance with the requirements of labor

management and sanitation departments in the living areas on construction site, and designated staff responsible for cleaning and disinfection shall be appointed.

7.5 Construction site domestic wastewater shall be discharged into the municipal sewer system or treated on-site using portable systems or septic tanks.

8. Occupational safety

8.1 At least one environment, health and safety (EHS) officer shall be appointed to manage occupational health and safety risks on construction sites.

8.2 Personal protective equipment (PPE) (safety hats and shoes and high visibility vests) shall be provided to all construction workers, with strict enforcement on all workers wearing PPE. Personal protective equipment (PPE) such as goggles, gloves and respirators shall be provided to construction workers doing interior fit-out to minimize skin exposure to chemicals and inhalation of VOC.

8.3 Ear plugs for hearing protection shall be provided to workers operating and working near noisy power mechanical equipment.

9. Food safety

9.1 Food hygiene in canteens on site shall be inspected and supervised regularly. Canteen workers must have valid health permits.

9.2 If food poisoning is discovered, effective control measures shall be implemented immediately to prevent it from spreading.

10. Disease prevention and health services

10.1 All construction workers shall undergo a physical examination before starting work on site. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. Physical examination shall be conducted on 20% of the workers every year from the second year onwards.

10.2 Health clinic shall be established at location where workers are concentrated, which shall be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents.

10.3 Induction and training by local health departments on prevention and management of communicable diseases shall be provided.

11. Social conflict prevention

11.1 The following shall be prioritized: (i) employ local people for works, (ii) ensure equal opportunities for women and men, (iii) pay equal wages for work of equal value, and pay women's wages directly to them; and (iv) not employ child or forced labor.

12. Community health and safety

12.1 A traffic control and operation plan shall be prepared together with the local traffic police prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours,

regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.

12.2 Construction billboards, which include construction description, schedule, responsible person and complaint phone number, shall be erected at the entry to each construction site and construction staging area.

12.3 Residents and businesses shall be informed in advance of noisy construction activities such as piling, given the dates and duration of expected disruption and made aware of the project grievance redress mechanism.

12.4 Clear signs shall be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations, etc. and raising awareness on safety issues.

12.5 All construction sites shall be made secure and access by members of the public shall be discouraged through appropriate fencing, signage and/or security personnel, as appropriate.

13. Utility interruption

13.1 Contractors shall assess construction locations in advance and identify potential for disruption to services and risks before starting construction. Any damage or hindrance/disadvantage to local businesses caused by the premature removal or insufficient replacement of public utilities shall be subject to full compensation, at the full liability of the contractor who causes the problem.

13.2 If temporary disruption is unavoidable the contractor shall, in collaboration with relevant local authorities such as power company, water supply company and communication company, develop a plan to minimize the disruption and communicate the dates and duration in advance to affected persons.

14. Grievance redress mechanism

14.1 The contractor's EHS officer shall be responsible for managing the grievance redress mechanism (GRM) on site for receiving and handling complaints. In case of a complaint, the contractor shall notify the GPMO within one week and shall advise on the agreed solution.

14.2 The contractor shall disclose the GRM to affected persons before construction begins at the main entrance to each construction site.

14.3 The contractor shall maintain and update a Complaint Register to document all complaints.

Technical Assistance Consultant's Report

Contract No. 129430-SC 107547
PRC: Guangxi Regional Cooperation and Integration Promotion Investment Program

Climate Risk and Vulnerability Assessment for Guangxi Regional Cooperation and Integration Promotion Investment Program, the People's Republic of China

DRAFT
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Prepared by Wei Ye

Asian Development Bank

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
ARI	annual recurrence interval
BEZ	border economic zone
CRVA	Climate Risk and Vulnerability Assessment
DI	Design Institute
FSR	The feasibility study report
GCM	General Circulation Model
GEV	generalized extreme value
GHGs	Greenhouse Gases
Guangxi	Guangxi Zhuang Autonomous Region
IA	Implementing Agency
IPCC	Intergovernmental Panel on Climate Change
masl	metres above sea level
MFF	Multitranche Financing Facility
PRC	the People's Republic of China
RCP	Representative Concentration Pathway (of Greenhouse gases)

A. Executive Summary

1. This study is a climate risk and vulnerability assessment (CRVA) of climate change impact on the Regional Cooperation and Integration Promotion Investment Program (RCI) at Guangxi Zhuang Autonomous Region (Guangxi), People's Republic of China (PRC). The RCI program is designed as a Multi-tranche Financing Facility (MFF) and is concentrated on the border area with Vietnam in southern Guangxi. The program area covers four prefecture-level municipalities of Qinzhou, Fangchenggang, Chongzuo and Baise and the counties or county-level cities under their respective jurisdictions. This climate CRVA is mostly focused on the infrastructure development subprojects in the RCI program. The infrastructure components in the program include construction of school buildings, administration buildings, commercial market facilities and roads. This study provides the context of the program area but the detailed assessment focuses on the three Tranche 1 infrastructure investment subprojects.

2. The RCI program area has a southern monsoon Asian sub-tropical climate, which is characterized by hot summer with warm winter and plenty of rainfall. Qinzhou and Fangchenggang are among the Chinese cities that have the highest annual rainfall, over 2000 mm on average. Heavy rainfall induced flood is a major natural hazard in the area. In addition, the RCI program area is characterized by complex geology and has frequent geological disasters, such as landslide, debris flow, and karst collapse. Geological disasters have a high correlation with rainfall intensity. In addition, both Qinzhou and Fangchenggang are coastal cities nearby the Beibu Gulf of China South Sea. Historically, high tide together with strong typhoon and tropical storm have caused backwater effects in the rivers or overtopped or destroyed the sea wall and lead to urban flooding in the cities, damaged inland infrastructure. In addition, the program area is situated in the south of the tropic of cancer. The heatwave from high temperature in the summer season has the potential to harm human health.

3. The climate change projections of 2050 and 2100 that were constructed for the program area based on the pattern scaling method. Different greenhouse gas concentration pathways (RCPs) published by IPCC were used in combination with different climate sensitivity to generate the uncertainty range of the global warming trend. The IPCC AR5 GCM model ensemble was used to produce the 'best guess' change scenarios for future climate, sea level and extreme rainfall.

4. It was found that climate change will likely have a profound impact on both temperature and precipitation in the program area. In comparison to climate change impact on the normal climate, climate change impact on climate variation such as heavy rainfall events will likely be even more significant. The future changing climate will have important implications for the RCI program. Sea level likely continues to rise; the heavy storm likely becomes more intensified; which indicates a higher flood and landslide risk in future. The daily maximum temperature change implies more severe heatwave events in future in terms both intensity and duration, with potential harmful effects to human health.

5. Several adaptation options were identified for Tranche 1 infrastructure subprojects based on the completed feasibility study reports. These adaptation options were discussed and agreed with staff of the implementing agencies (IAs) and design institutes (DIs): adjustment of drainage system design to increase capacity to accommodate additional rain water due to enhanced storm intensity; allocation of additional electricity supply for air conditioning system; provision of space for air conditioning system facilities. Options out of the scope of RCI program were provided to EA, IA and DI as suggestions and recommendations: examination of the

planned slope stabilization measures to ensure greater resilience to enhanced surface flood risk; planning green space in the project area with native vegetation; and awareness raising and preparedness training for heatwave conditions.

B. Introduction

6. The investment program will help the PRC to achieve its strategic objective of greater integration with the global economic system through improved connectivity and strengthening of regional economic cooperation and integration. The program is aiming to assist Guangxi in implementing its action plan for regional cooperation and integration with the members of the Association of the Southeast Asian Nations (ASEAN), particularly the Greater Mekong Subregion (GMS) countries. The program will stimulate economic corridor development between Guangxi and the northern border provinces of Viet Nam by: (i) promoting sustainable small and medium enterprise (SME) development and investment in the border areas; (ii) facilitating efficient cross-border financial transactions and investments; (iii) facilitating adoption of new technologies such as e-commerce to improve logistics and access to market information; (iv) upgrading cross-border transport linkages through improved physical connectivity and operational and policy coordination at key border crossing points; and (v) improving infrastructure, social- and trade-related services in border economic zones (BEZs).[1]

7. Guangxi's action plan includes a list of priority investment projects that are intended for financing over 2014–2022 by various national and regional funding sources, multilateral development banks such as ADB, and the private sector. The PRC government has requested ADB to provide a $450 million MFF loan to fund a portion of the long-term investment needed for implementing Guangxi's strategies and action plans for both the GMS and the Belt and Road Initiative.[2]

8. The RCI program includes a series of subproject components that are proposed to be implemented in 3 tranches, include infrastructure developments. As infrastructure is designed to provide long term service climate change could pose various threats. The long term climatic averages and extreme weather events are important factors which need to be considered in the planning, design, operation, maintenance and management of an infrastructure project. Climate change will likely alter both long term climatic averages and the frequency and severity of extreme weather events. For a sustainable infrastructure project development, it is thus important to make climate adaptation adjustments to engineering specifications, alignments, and master planning; incorporating associated environmental measures; and adjusting maintenance and contract scheduling (ADB 2010). Effective climate-proofing of an infrastructure project requires project specific climate risk and vulnerability assessment to identify, evaluate and implement feasible adaptation measures to strengthen project resilience to future climate change impacts. The objective of this study is to conduct climate change risk and vulnerability assessment (CRVA) for the RCI program, with specific attention being paid to infrastructure subprojects in Tranche 1.

[1] The Asian Development Bank (ADB) provided project preparatory technical assistance for preparation of the Proposed Multi-tranche Financing Facility People's Republic of China Guangxi Regional Cooperation and Integration Promotion Investment Program (TA-9120 PRC).

[2] The Silk Road Economic Belt and 21st Century Maritime Silk Road (the Belt and Road Initiative) is a strategic initiative to promote connectivity and strengthen economic partnerships between and among Asian, European and African continents in the spirit of open regionalism and identifies priorities for cooperation. (Guangxi has developed its own Belt and Road action plan with special emphasis on strengthening cooperation with the members of the ASEAN, particularly the GMS countries.

C. Climate Hazards in the RCI program area

9. Guangxi is situated in the south of PRC, with the tropic of cancer traversing the region from the middle. Mountains are the dominant topography of the region, which occupy most area in the southwest, west and north. Guangxi adjoins the Beibu Gulf of the South China Sea in its south and the southeast area is mostly hills with patchy alluvial plains (Figure 1). Guangxi is strongly influenced by the south Asian monsoon, it has a warm climate with plenty of rainfall.

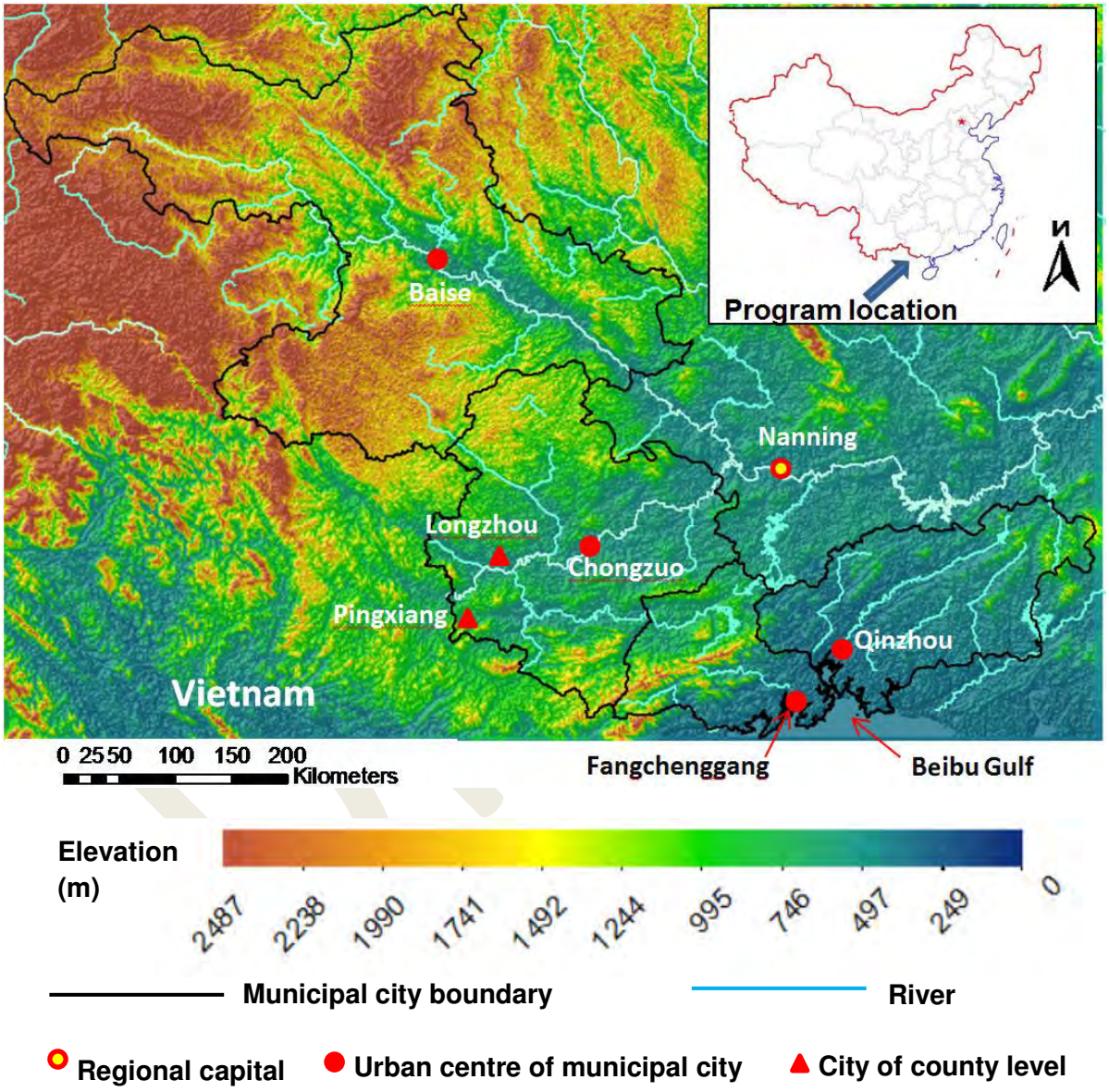


Figure 1: The program location with elevation and river network. Red spots are the location of the urban area for cities at various levels. Tranche 1 infrastructure subprojects are situated in Fangchenggang and Pingxiang

10. Rainfall varies significantly between seasons. The half year rainy season (April to September) receives more than 70% of the annual rainfall, and heavy storm is frequent in the rainy season. Flood and drought are the major climate hazards in Guangxi. Other climate hazards include frost damage, strong wind, hails and tropical cyclones. Geologically, Guangxi has the largest karst topography in China[3] and is among the regions that has the most serious rocky desertification. Geological hazards, such as landslide, debris flow, and karst collapse, have occurred frequently in the region.

11. Economically Guangxi is one of the less developed regions (at provincial level) in China. The annual GDP per capita is ranked 27 among 32 provinces and provincial level regions (2013 data) (GDRC, 2013).

12. The proposed RCI program will be implemented at four prefecture-level municipalities of Qinzhou, Fangchenggang, Chongzuo and Baise and the counties or county-level cities under their respective jurisdictions. The program area is located in south Guangxi, along the border between PRC and Vietnam, where the latitude spans from 21.5°N to 25.0°N and longitude from to 104.5°E to 109.5°E. The elevation declines from the mountainous region in the northwest to the hilly and coastal low lying area in the southeast, with elevation varies from sea level of Fangchenggang and Qinzhou to over 1600 metre above sea level (masl) in Baise (Figure 1).

13. Of the four municipal urban cities under the RCI program, Baise and Chongzuo are situated at the southeast edge of the Yunnan-Guizhou Plateau. Mountains dominate the land area. The Youjiang River crosses Baise from northwest to southeast and is the major river network in Baise. The river channel is 388 km long above Baise urban area with average slope of 4.01‰. The Baise urban area is surrounded by mountains and has typical basin topography. The heavy storm is the major climate hazard in Baise, which accounts for 76% of total climate hazards in history (Li, 2011), and has resulted in huge economic loss to Baise. The storm of October 1997 triggered landslides causing 3 deaths, 191 house collapses, and damage to more than 450 road section (including 7 bridges). The direct economic loss was more than CNY42 million. The storm of July 2007 destroyed 75 houses, disrupted transport along 29 road sections and also led to heavy economic losses (Li. 2011). The Zuojiang River crosses Chongzuo from west to east and is the major river network of Chongzuo. It is the second order tributary of Zhujiang River, the second largest river in China in terms of the total discharge (the first is the Yangtze River). According to the Chronicle of Chongzuo, there were three historic severe river flood events of Zuojiang River that inundated Chongzhuo urban area, which happened in 1881, 1955 and 1986 (Nong 1994).

14. Both Fangchenggang and Qinzhou are coastal cities that adjoin Beibu Gulf in the south. The topography of these two cities is mainly small hills and alluvial plains. The rivers in these two cities are largely small rivers and discharge directly to the Beibu Gulf. The cities are of maritime climate condition and are also under strong influence from the south Asian monsoon. The cities have the highest annual rainfall in China, particularly Fangchenggang. The urban drainage system is out-dated and lags behind urban development. Heavy storm has given rise to severe urban flooding. Furthermore, the sea tidal fluctuation of the Beibu Gulf exacerbates the flood hazard. High tide with storm or tropical cyclone causes backwater effects in the rivers, and/or overtops/damages sea embankment and consequently inundates the urban area. In August 2012, the typhoon Kai-tak flooded the cities. In Qinzhou, two thirds of the urban roads

[3] Karst topography is a geological formation shaped by the dissolution of a layer or layers of soluble bedrock, usually carbonate rock such as limestone. Some of the karst landscapes in Guangxi are included in the South China Karst UNESCO World Heritage Site designation as having outstanding universal value http://whc.unesco.org/en/list/1248.

were inundated, the deepest area was more than 1.5 m under water (Huang et al. 2014). During summer of 2014, Typhoon Rammasun resulted in record breaking heavy storms that hit the cities successively, causing major damage to both cities. Direct economic losses were more than CNY5 billion for Qinzhou (Qinzhou government news, 2015) and more than CNY4 billion for Fangchenggang (Fangchenggang News, 2016).

15. Heatwave is another climate hazard that potentially may threaten human health in the future. Previous research suggests that extreme heatwaves are associated with heightened levels of human morbidity and mortality (Kunst et al. 1993; Hajat et al. 2002). Data from Shanghai for 1975–2004 shows that the urban heat island effect and extremely high temperatures are directly responsible for an increased summer mortality rate (Tan et al. 2010). A series of heatwaves occurred in Guangxi during the summer of 2010. The heat related morbidity rate increased significantly but related mortality was low, only one heat related death observed in Nanning City (Qin and Li, 2011). Currently heatwave events are relatively rare in the program area and no research has been conducted specifically for the program locations.

16. Climate disasters are the major natural hazards threatening the urban cities in the RCI program area. Geological hazards have close correlation with climate, and are usually induced by storm. In the future, climate change will likely strengthen the rainfall intensity, and any potential sea level rise will also exacerbate potential tropical storm damage to coastal areas. It is important to take the future climate change scenarios into account in the planning and design of any infrastructure project, in order to ensure the long-term project service can be delivered as planned.

D. Purpose and scope of this study

17. This study aims to provide a general assessment of potential risks posed by climate change to the RCI program. The focus is on infrastructure subproject components. Further detailed assessment was conducted for the infrastructure subprojects proposed for Tranche 1 based on the completed feasibility study reports (FSRs). The overall objective of this study is to identify and minimize future climate change risks to the RCI program through scientifically based impact assessment and adoption of feasible adaptation actions to improve resilience.

18. There are 10 subprojects in Tranche 1. Of these 10 subprojects, three will involve civil works for the construction of training and cross-border trade services facilities in Fangchenggang and Chongzuo. This study focuses on Tranche 1 civil infrastructure subprojects, which have completed FSR and relevant information as listed in Table 1.

19. The risk assessment will consider changes in temperature, rainfall and sea level based on outputs from the latest climate change research findings. Two future timeslices, i.e. 2050 and 2100 are analysed in this study to represent mid-term and long-term future conditions. Based on the findings, adaptation options have been recommended.

Table 1: List of civil infrastructure subproject in Tranche 1

Location	Subproject Name	Subproject Contents and Funding Requirements
Gongkou District of Fangchenggan Municipal City	Construction of Fangchenggang Training Centre for Chinese and Vietnamese Workers and SMEs	Construction of five buildings of 4-6 stories on the existing Fangchenggang Poly Tech Vocational School campus for training in trade and commerce services, student dormitories, sports management and offices.
Pingxiang of Chongzuo Municipal City	Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang BEZ	Construction of four 4-storey buildings for use as training centre, demonstration centre (for product exhibition), skill development and exchange centre and offices; and one 6-storey building for staff dormitory.
	Expansion of Pingxiang Border Trade Service Center	Construction of 13 buildings and facilities of 1-3 storeys for use as warehouses, border trade, custom declaration and inspection, banking, payment and account settlement, etc.

20. The main focus of this study is infrastructure subproject components that are vulnerable to changes in temperature and rainfall and their variability; the required information to support this CRVA is historical observed temperature and rainfall at the appropriate spatial and temporal scale and future climate change projections based. Relevant daily rainfall and temperature data was collected for 4 meteorological stations in the area.

21. Section E describes the methodology for the CRVA. Details of the baseline and scenario datasets used for climate impacts assessment are provided in Section F. Given the generated climate change scenarios, Section G describes the detailed impact assessment for Tranche 1

subprojects and identifies implications of climate change vulnerability on the subproject design. Section H discusses the adaptation options based on the completed FSRs. The report concludes with main findings of this study, identifies constraints and limitations and future recommendations.

E. Methodology

22. A risk is the product of the magnitude of the hazards and the vulnerability of an object; while the vulnerability of an object is determined by its exposure, sensitivity and adaptive capacity to the hazard. In this study, hazard is used to denote the threat from climate variables such as precipitation, extremes and aftermath. Exposure is referred to the presence of assets or people that could be adversely affected when a hazard happens and which, thereby, are subject to potential harm, loss, or damage. Vulnerability is defined generally as the susceptibility to be adversely affected by climate hazards. Vulnerability can be either physical or socio-economic. Tranche 1 subprojects are vulnerable to potential rainfall induced water damage and human health is vulnerable to heatwave. The vulnerability also derives from ecosystem degradation due to human activities in the area. This section describes the methodology of identifying climate variables that may become hazardous to the subprojects and their projected future change. The climate change projections focus on the relative changes between historical and future periods by applying an ensemble based pattern scaling approach.

E.1 Overall approach

23. The first step in CRVA is the construction of the future climate change scenarios. The construction of climate change scenarios involves the development of the baseline climate condition and the future climate change projections. Depending on the study objectives, spatial and/or site specific climate change scenarios are needed for impact assessment. In this study, the baseline spatial climatology for the RCI program areas was obtained from the WorldCLIM database (http://www.worldclim.org). The station based observed data collected was used for developing the site specific baseline climate condition.

24. The future climate projection is subject to considerable uncertainty. Uncertainty is a key element in most aspects of climate change. The decision on adaptation options must take careful account of the degree of uncertainty, the long-time horizons and the range of possible outcomes. The lifespan of a project may set the best time horizon for CRVA. One important aspect is to comprehend such an uncertainty range in decision making and policy planning process. Within this context, any climate change scenario constructed on a single Greenhouse Gas (GHG) emission rate and/or individual GCM outputs is generally considered inappropriate for CRVA purposes, because it cannot provide information on the uncertainty that characterizes future climate for a given location and from all uncertainty sources. The first important uncertainty is the future atmospheric GHG concentration. The GHG concentration will vary depending on how the future world develops socio-economically. Global economic development driven mainly by fossil-fuels will cause higher GHG concentrations than more sustainable, lower emission global economic development. To reflect such uncertainties, different GHG Representative Concentration Pathways (RCPs) were used by IPCC AR5 to represent different trajectories of future GHG concentrations that would result in radically different radiative forcing by the year 2100. It should be borne in mind that each RCP itself is subject to additional uncertainties arising from incomplete understanding by the modelling communities as regard to the processes involved in converting GHG emissions into atmospheric concentrations and radiative forcing as reflected, for example, in the different results obtained from various carbon cycle models. The second important uncertainty results from limitations in the scientific understanding of the response of the climate systems to radiative forcing. Consequently, there remain large differences between GCMs in their projections of global-mean temperature change. These are due largely to the differences in the ways in which climate feedback is modelled. For example, cloud feedbacks, which can enhance or dampen rates of global warming. The metric

"climate sensitivity", broadly defined as the equilibrium global mean surface temperature change following a doubling of atmospheric CO_2 concentration, captures these uncertainties. Thus a combination of different RCPs and climate sensitivities can be used to characterise future scenarios that reflect the major uncertainties at the global scale. The three RCPs used in this study, RCP4.5, RCP6.0, and RCP8.5, are named after a possible range of radiative forcing values in the year 2100 (of 4.5, 6.0, and 8.5 W/m^2, respectively). RCP6.0 with mid-climate sensitivity represents a middle range future global change scenario, which was used as an indicator of the mid-scenario projection of future global change, while RCP4.5 with low-climate sensitivity and RCP8.5 with high-climate sensitivity was used as indicators of the corresponding low and high bounds of the uncertainty range (Table 2). The third important uncertainty in climate change scenario generation is the difference between GCM simulations for given regions or locations. At the regional-to-local scale, the uncertainties expend in terms of the spatial patterns of climate change. As the current climate science still cannot identify any individual GCM that may be superior to others in simulating future climate change, it makes the CRVA a challenge because of the three key sources of uncertainties. To account for such an uncertainty in CRVA, a pattern scaling method (see Appendix 1 for detailed calculation process) was adopted and applied to a wide range of GCMs to build a model ensemble.

25. The advantage of pattern-scaling method is that the three key uncertainties – the future radiative forcing, the climate sensitivity and the GCM projected change – can be treated independently and combined flexibly and quickly to produce future climate scenarios (Wigley, 2003), while the key assumption underlining the pattern-scaling method is that, at first the RCPs can accurately represent the global responses of a GCM even when the response is non-linear (Raper et al, 2001); and secondly for a GCM, the change of its climatic variables are a linear function of its global annual mean temperature change at different spatial and/or temporal scales. This study made use of the GCM model results from phase 5 of the couple model intercomparsion project (CMIP5), which was the data supporting the IPCC AR5 (see Appendix 2 for the GCM included). All 40 GCMs with monthly data outputs were used in spatial GCM scenario generation. Of the 40 GCMs, the 20 GCMs that have daily GCM outputs were used in extreme rainfall scenario construction; and the 24 GCMs that have sea level outputs were used in sea level change scenario construction.

26. As pointed out by Reichler and Kim (2008), the average simulation from model ensemble for a climate variable is normally used to capture the middle conditions, because the average often agrees better with observed climate than any individual model estimates. However, it was found that, though all GCMs has reasonable agreement in climate simulation at global or continental scale, the difference of GCMs results could be significantly large for local areas or small regions, which indicates a huge uncertainty at such spatial scales. Furthermore, this uncertainty is not consistent spatially; hence it is difficult to identify and eliminate certain GCMs from model ensemble. The one or two 'outlier' GCM results could generate a very biased projection for the average value of the ensemble. In this study, the median of the model ensemble, instead of the average, was used in order to provide a "best estimate" scenario of future change. It is worthwhile to note that we only use the median value in this study, mainly due to the relative small ensemble size. Ideally top and bottom percentiles should also be used to determine the high and low uncertainty range bounds, but for practical purposes of guidance for policy and action this often tends to expend the scenarios to the point of being unmanageable and/or unusable. Again this is particularly true given the relative small size of ensemble.

Table 2: Three climate projections and their input conditions represent the uncertainty ranges

Climate projection	Representative Concentration Pathways	Climate sensitivity
Mid scenario	RCP6.0	Mid
Low scenario	RCP4.5	Low
High scenario	RCP8.5	High

E.2 Spatial climate change scenario

27. Annual and monthly climate change impact was assessed spatially over the RCI area. The baseline climatology was obtained from the WorldCLIM database with a spatial resolution of about 1 km (http://www.worldclim.org). In generating the climate change scenario for the RCI area, the simulation results from 40 GCMs that were assessed in the IPCC AR5 were used. All 40 models have their monthly simulation results available.

E.3 Site specific climate change scenario

28. Besides the spatial monthly change projections, site specific climate change scenarios with a more detailed temporal scale are usually required for impact assessment. The site specific climate change scenario was constructed by adjusting the station observed daily data using the normalised GCM pattern value from the GCM grid where the climate station is located. In this report, the baseline data was constructed from the observation data of the period 1986-2015. For site specific extreme value analysis, an intensity value such as maximum daily rainfall of 20 year annual recurrence interval (ARI) was chosen and then its normalised pattern value from the GCM gird where the site is located was selected. The value is then applied to the same rainfall intensity that was derived from the observed historical data to generate the future change scenarios.

29. In the following two sections, the method described above is adopted to generate the change projections for climate variables that may become hazardous to the proposed RCI subprojects. Rainfall and/or temperature data were collected for four stations around the RCI area. Table 3 lists the information for the stations. The locations of the stations can be found in Figure 1.

Table 3: Information of the meteorological stations

Station Name	Longitude (°E)	Latitude (°N)	Altitude (m)	Observation Period
Nanning	108.22	22.63	121.6	1951-2015
Qinzhou	108.62	21.95	4.5	1952-2015
Longzhou	106.85	22.33	128.8	1953-2015
Baise	106.60	23.90	173.5	1951-2015

F. Climate observations and change projections

F.1 Observational temperature data and their future projections

30. The temperature related climate variables that might have high risk potential is heatwave hazard and impacts on human health. The RCI program area is in the south of the Tropic of Cancer, so have hot and humid summers. Figure 2 illustrates the spatial annual mean temperature of the baseline and 2050 and 2100 projections under a mid-climate change scenario. Except the high altitude of the mountainous area surrounding Baise, the program area generally has an annual average mean temperature above 21°C (Baseline of Figure 3). The annual mean temperature is likely to increase between 1.1°C to 1.3°C by 2050 and 2.2°C to 2.5°C by 2100, according to the median scenario projection. The northwest area has a slightly higher warming rate than the southern area.

31. Figure 3 shows the observed annual mean temperature of the 4 meteorological stations. As shown in Figure 3, a warming trend has already been observed for all stations. It is relatively strong for the northwest inland station of Baise, which has an average increase rate of 2°C/100 years, but it is less obvious for coastal station of Qinzhou.

32. The warming rate due to climate change on temperature is similar for each month for the mean temperatures. Figure 4 shows the monthly observed monthly normal mean temperature and its 2050, 2100 projections and uncertainty ranges for the 4 stations. The climate change impact on the maximum temperature is similar for the mean. The influence of heatwave on human health is closely related to the intensity of heatwave, which is defined as the duration of continuous days of maximum temperature over a given threshold. The heatwave change scenarios are discussed in Section G.

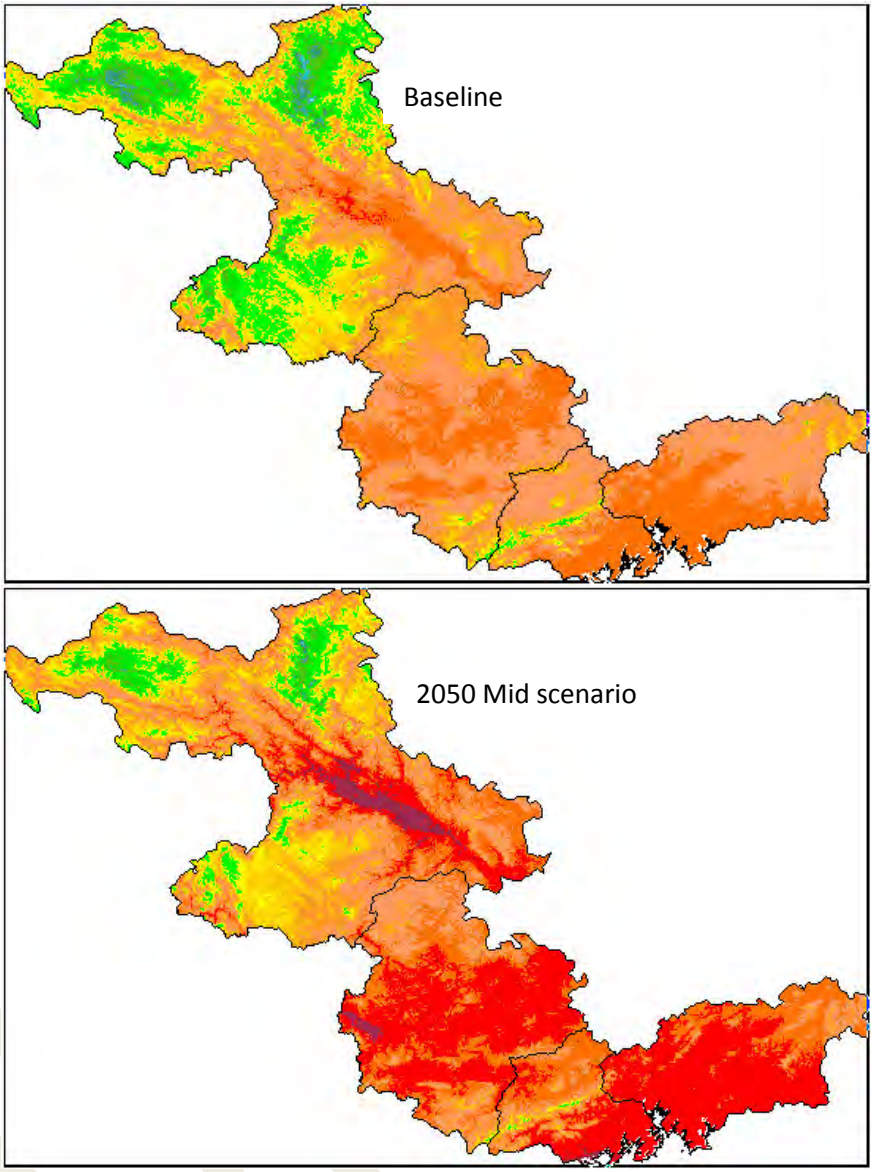
F.2 Observational rainfall data and their future projections

Baseline:

33. Figure 5 shows the spatial rainfall distribution for the rainy season (June-October). There is a high spatial variation in rainfall over the RCI program area. The northwest mountainous area has the lowest annual average rainfall between 1000 to 1100 mm, which is less than half received by the southeast coastal area that is over 2400 mm (baseline shown in Figure 5). The coastal area of Fangchenggang receives heavy rainfall, because it is under the combined effects of a maritime climate and south Asian monsoon.

34. Figure 6 shows the observed annual rainfall for the 4 stations. The annual average rainfall is clearly over 2000 mm for the coastal city of Qinzhou, but it is merely above 1000 mm for the northwest inland city of Baise. The Coefficient of Variation (CV) is between 0.17 and 0.20, which indicates that the inter-annual variation of rainfall is not very strong (Table 4). Unlike the temperature, there is no consistent change trend in annual rainfall from the observations. While Qinzhou demonstrates an upper trend, the Longzhou rainfall is slightly downward, and Nanning and Baise do not show a clear trend.

35. In contrast to the inter-annual variation, the rainfall shows a very high seasonal variation. Figure 7 shows the observed monthly normal rainfall and its 2050, 2100 projections for the 4 stations. The average rainfall for four months from June to September accounts for more than half of the annual total. On average June is the wettest month for three stations except Qinzhou where July has the most rainfall. December is the driest month for all stations.



2100 Mid scenario

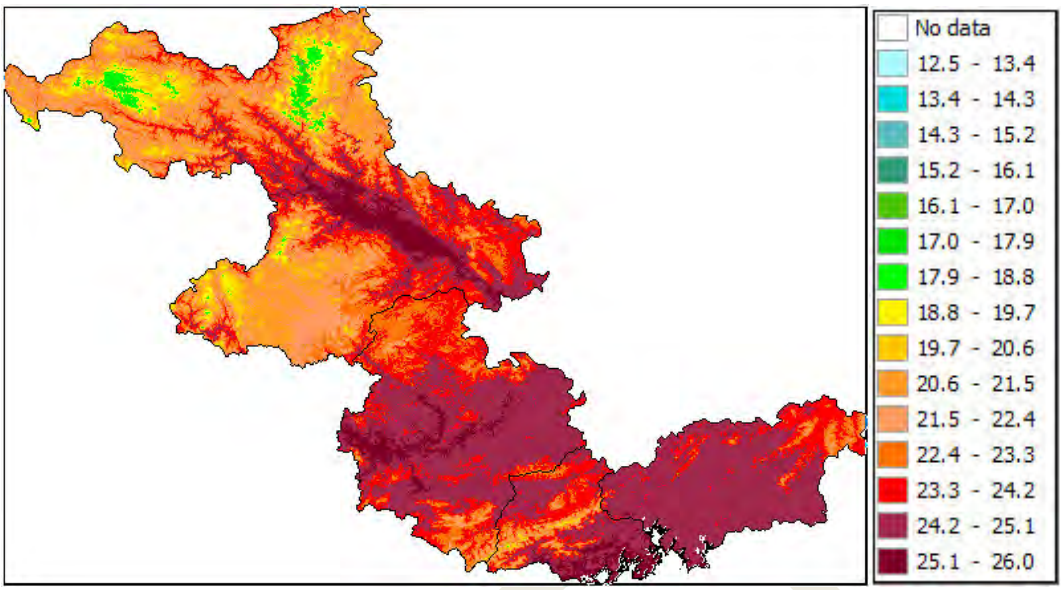


Figure 2: Baseline annual average mean temperature (°C) and 2050, 2100 projections based on the mid scenario projection

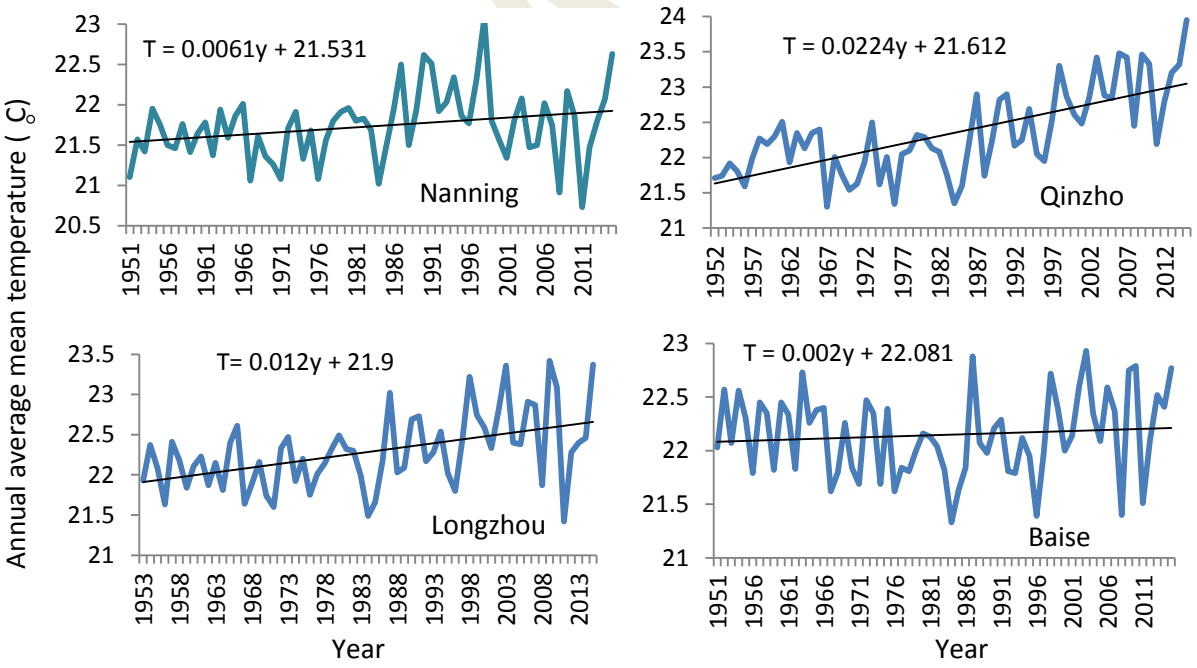
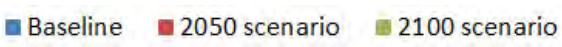


Figure 3: Observed annual average mean temperature (°C)



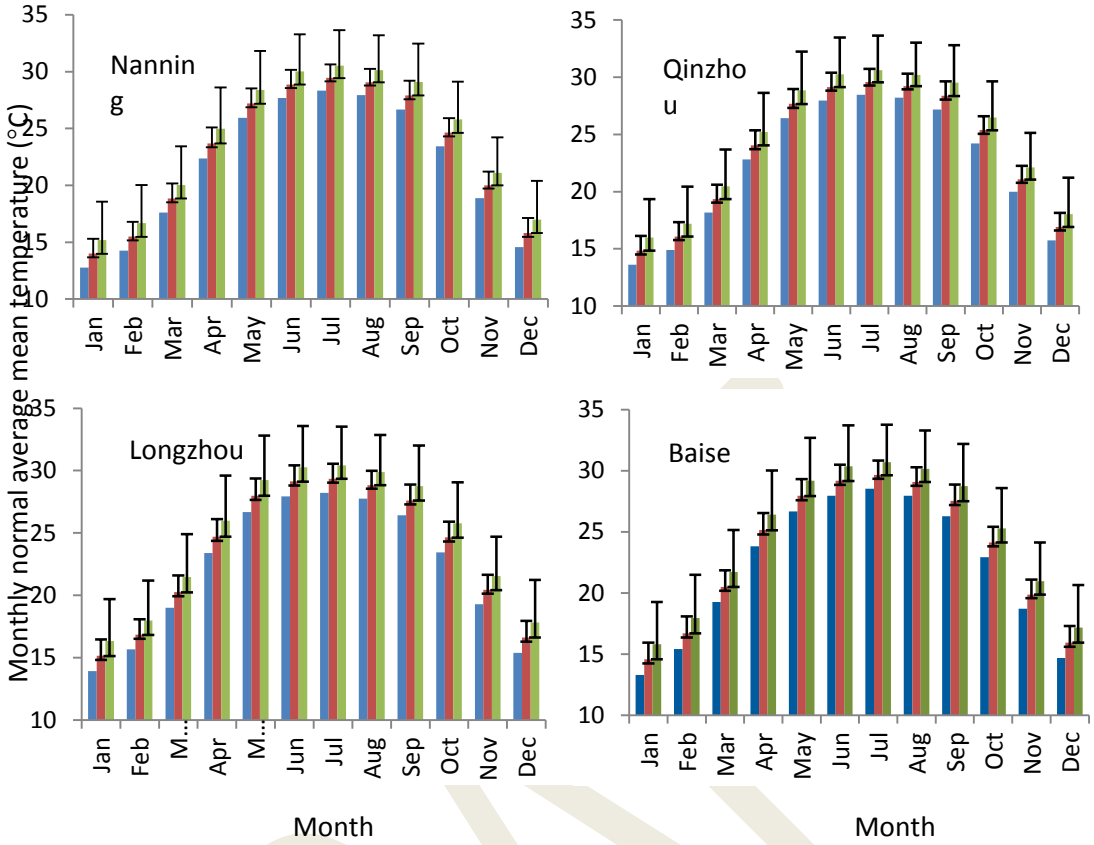
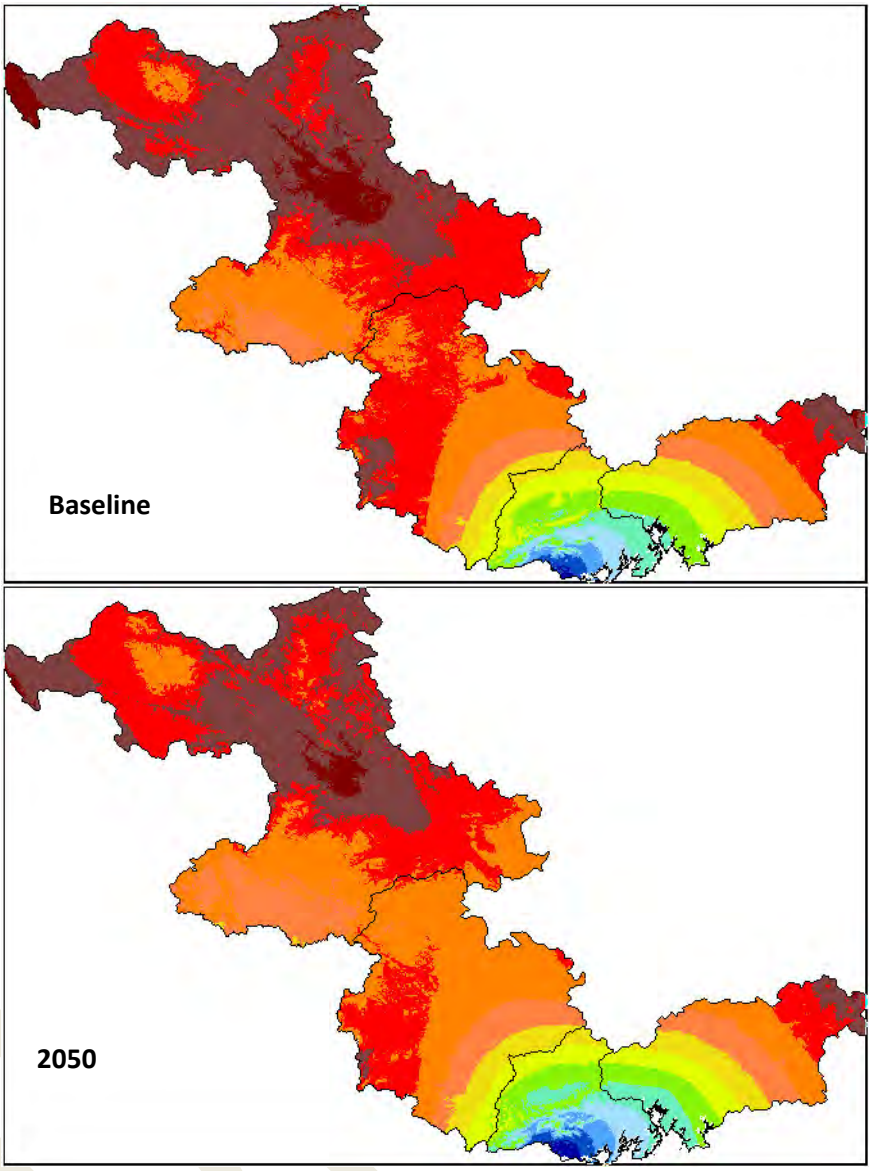


Figure 4: Baseline monthly normal mean temperature (°C), 2050 and 2100 projections. The bar indicates the uncertainty range of the climate change projection as defined in Table 2


Baseline
2050

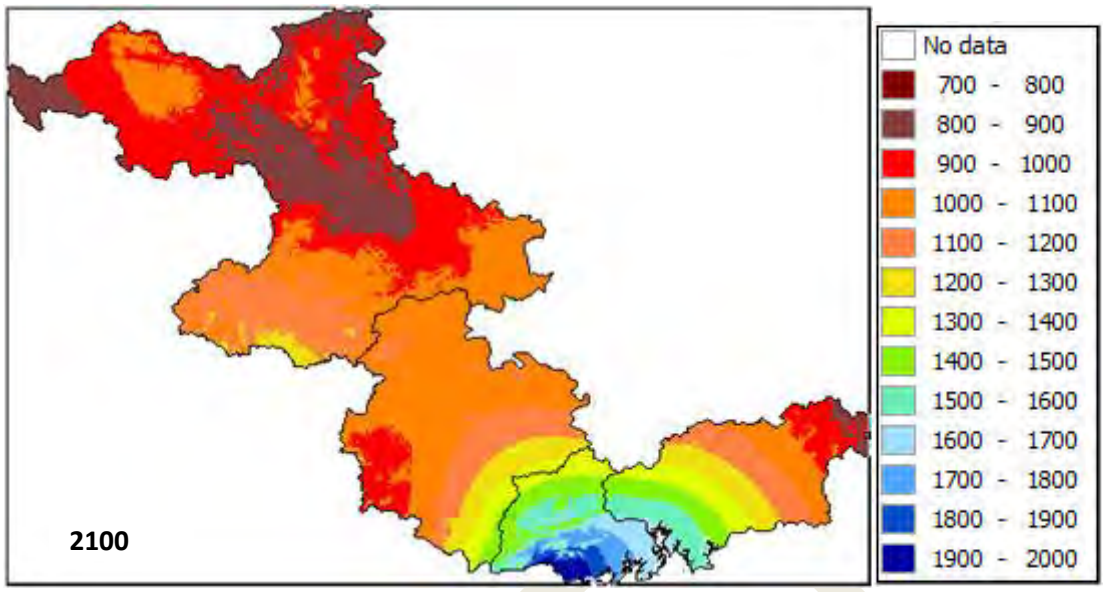
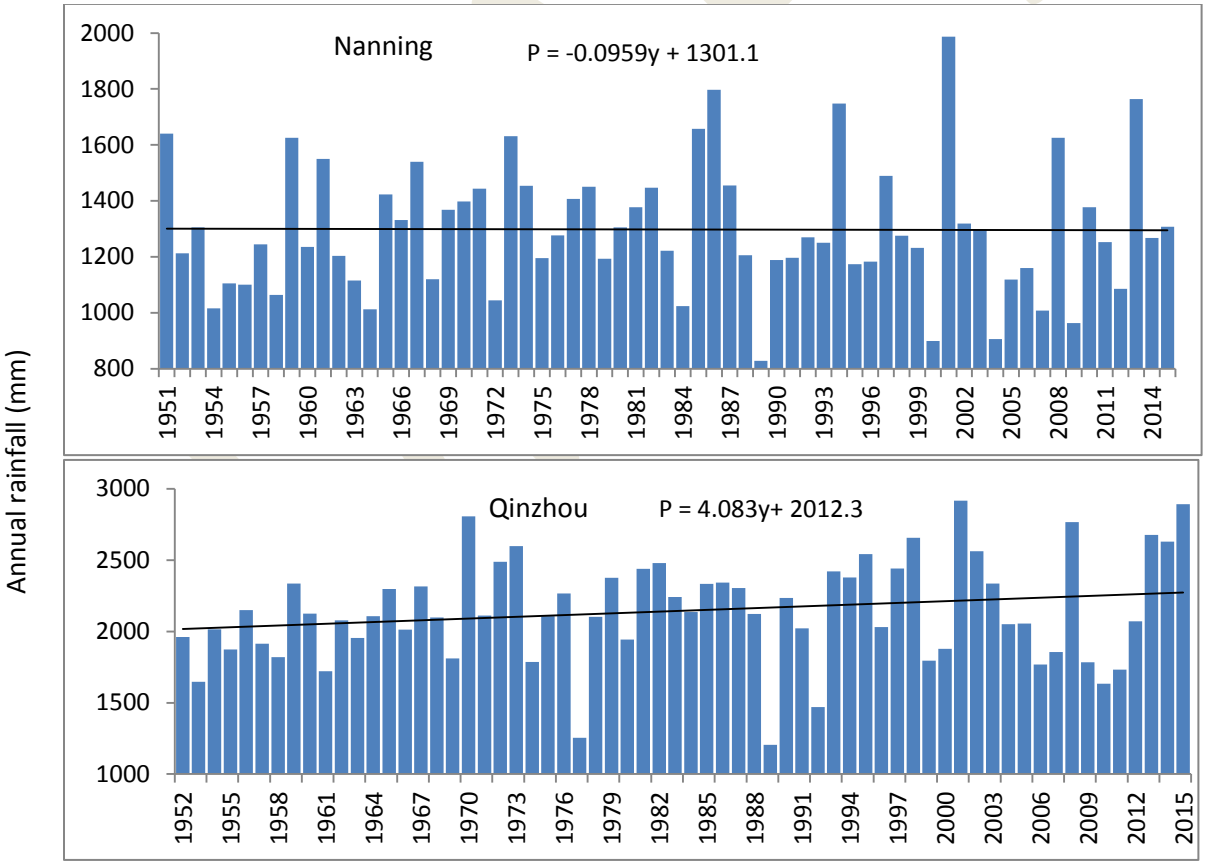


Figure 5: Baseline rainfall (mm) of the rainy season (Jun-Oct) and 2050, 2100 projections based on the mid scenario projection



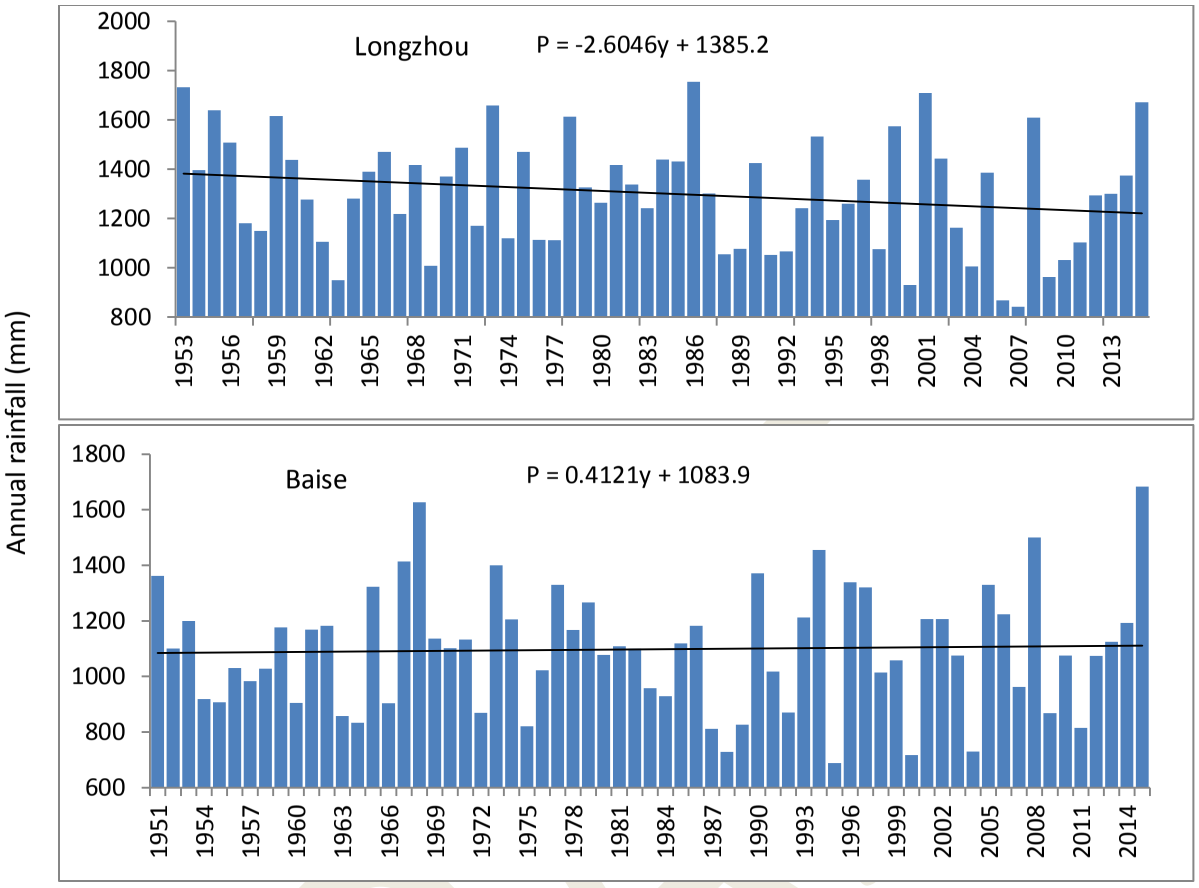


Figure 6: Observed annual rainfall of the 4 stations (mm)

Baseline 2050 scenario 2100 scenario

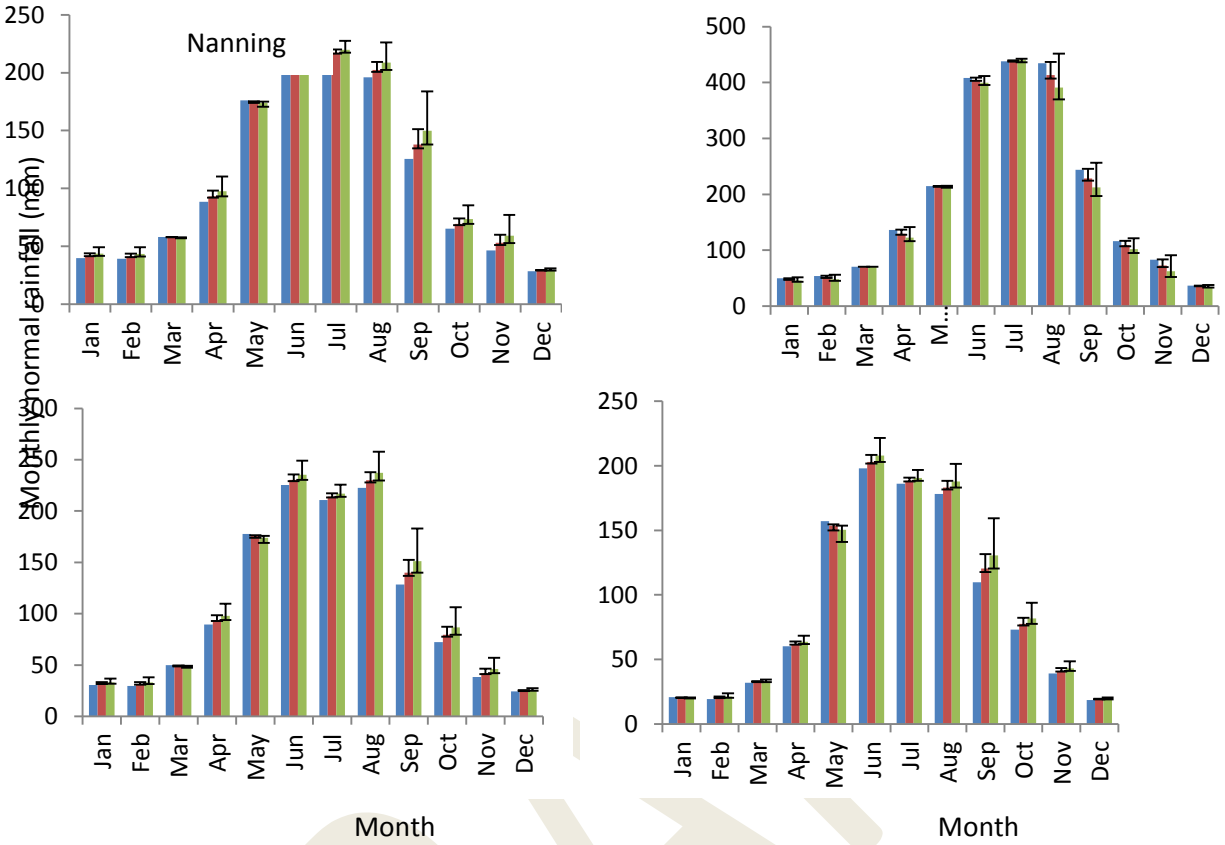


Figure 7: Monthly normal rainfall and climate change projection.The bar indicates the uncertainty range of the climate change projections as defined in Table 2

Table 4: General rainfall information for the four stations

Station name	Annual average precipitation (mm)	CV	Maximum annual precipitation (mm)	Minimum annual precipitation (mm)
Nanning	1297.95	0.18	1987.50	827.90
Qinzhou	2145.04	0.17	2917.10	1204.60
Longzhou	1295.87	0.18	1755.00	841.80
Baise	1097.50	0.20	1683.30	688.80

Future projection

36. Applying the method described in the previous section to the RCI area, the median scenario change projection indicates the annual rainfall change in the area will also likely be noticeable, with an average increase across the area of 2.5% in the northwest to 3.5% in the southeast by 2050 and 4.5 to 7.0% by 2100 across the area. The climate change projection indicates that the spatial variation of rainfall may become even larger in the future (2050 and 2100 projection in Figure 5), as the current wettest area likely receives even more rainfall than relative drier areas.

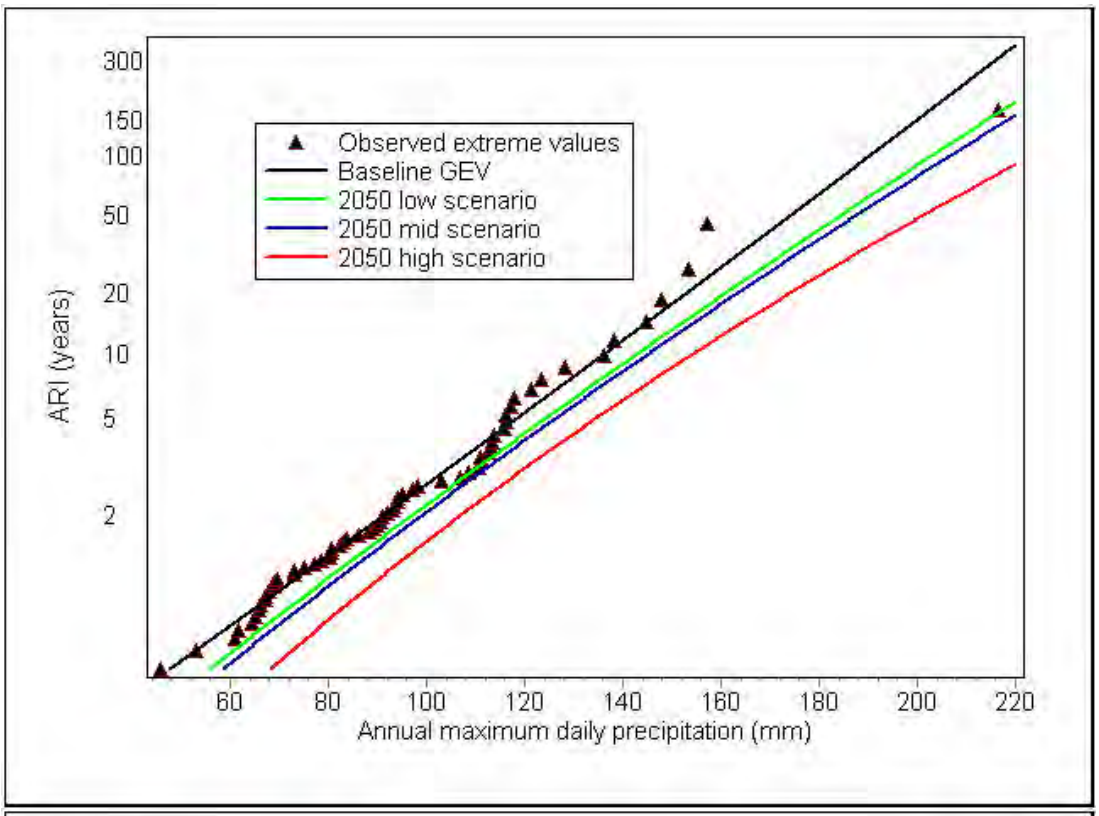
37. At a site specific scale, the projected rainfall increase is clear for the rainy season, but much less for the dry season. The dry period of January to March of Qinzhou even shows a slight decrease trend (Figure 7). Such a scenario projection implies an increased storm and flood risk for the area, particularly for the coastal area.

Extreme rainfall and its projection

38. According to the extreme value theorem, the generalized extreme value (GEV) distribution, which combines type I, II and III extreme value distribution, is often used as an approximation to model the normalized maxima (minima) of a long (finite) sequence of independent and identically distributed random variables such as annual daily maximum rainfall. In this study the GEV distribution was applied to the daily observation to investigate extreme rainfall and their future changes. A detailed method description and analysis process can be found in Ye and Li (2011). The annual maximum daily rainfall and its future projection were investigated in detail because the sub-daily rainfall data was not available. Figures 8 and 9 illustrate the GEV distribution of the annual maximum daily rainfall of Qinzhou and Longzhou and their 2050 and 2100 future projections. The right-shifting of the projected GEV distribution indicates an increment in daily rainfall intensity or frequency. Table 5 lists the assessment of climate change impact on the extreme daily rainfall for the 2 stations. According to Table 5, the baseline 5 year ARI annual maximum daily rainfall of Qinzhou is 229.95 mm, which is derived from historical record. The climate change alters the climate regime, and the same ARI event will likely have 242.42 and 254.34 mm by 2050 and 2100 respectively, following the mid scenario projection..

Table 5: The GEV results of annual maximum daily rainfall and its future projections

Station Name	ARI (years)	Baseline	2050 scenario			2100 scenario		
			Low	Mid	High	Low	Mid	High
Annual maximum daily rainfall projection (mm)								
Qinzhou	2	175.63	184.10	187.3	198.67	187.02	197.55	226.73
	5	229.95	239.06	242.42	255.64	242.31	254.34	288.57
	10	262.46	273.22	277.20	292.96	277.07	291.40	332.44
	20	291.28	304.41	309.26	328.46	309.10	326.56	376.85
Longzhou	2	92.46	98.07	100.10	107.94	100.03	107.17	127.13
	5	118.74	124.39	126.48	134.69	126.40	133.88	155.21
	10	135.98	142.27	144.60	153.80	144.52	152.89	176.85
	20	152.40	159.78	162.50	173.26	162.41	172.19	200.25
Change in Annual maximum daily rainfall projection (%)								
Qinzhou	2	-	4.83	6.55	13.12	6.49	12.49	29.10
	5	-	3.96	5.42	11.17	5.38	10.61	25.49
	10	-	4.10	5.62	11.62	5.57	11.03	26.67
	20	-	4.51	6.18	12.77	6.12	12.12	29.38
	Average change		**4.35**	**5.94**	**12.17**	**5.89**	**11.56**	**27.66**
Longzhou	2	-	6.07	8.26	16.74	8.19	15.92	37.50
	5	-	4.76	6.52	13.43	6.46	12.75	30.71
	10	-	4.63	6.34	13.10	6.28	12.44	30.06
	20	-	4.84	6.62	13.68	6.57	12.99	31.40
	Average change		**5.07**	**6.94**	**14.24**	**6.88**	**13.52**	**32.42**



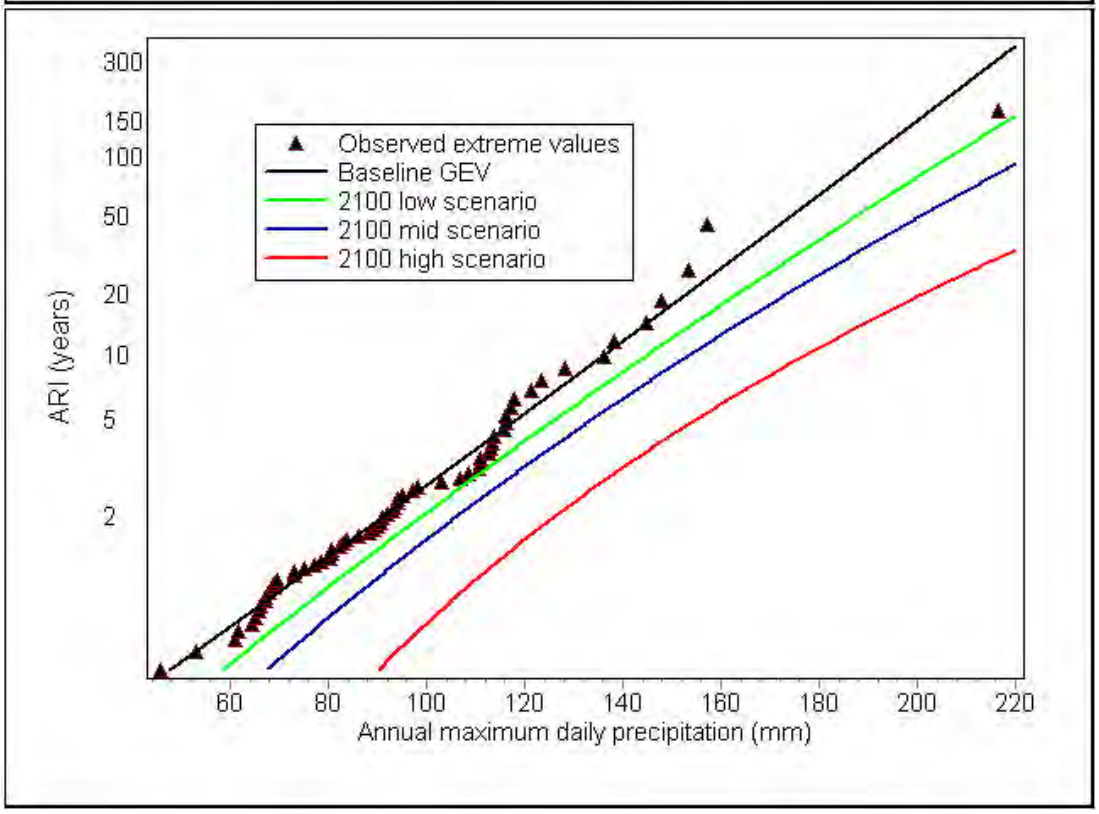
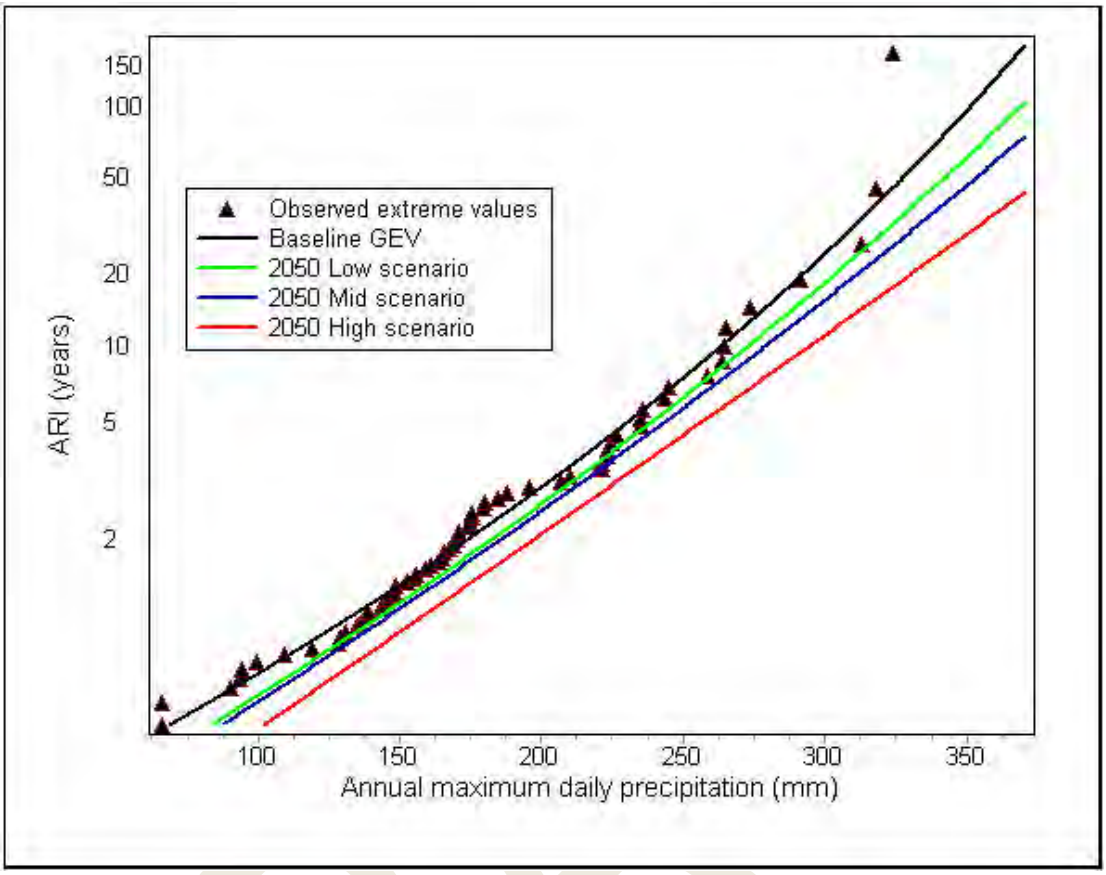


Figure 8: Climate change impact on Qinzhou annual maximum daily rainfall


150
100
50
20
10
5
2
ARI (years)
Observed extreme values
Baseline GEV
2050 Low scenario
2050 Mid scenario
2050 High scenario
100
150
200
250
300
350
Annual maximum daily precipitation (mm)

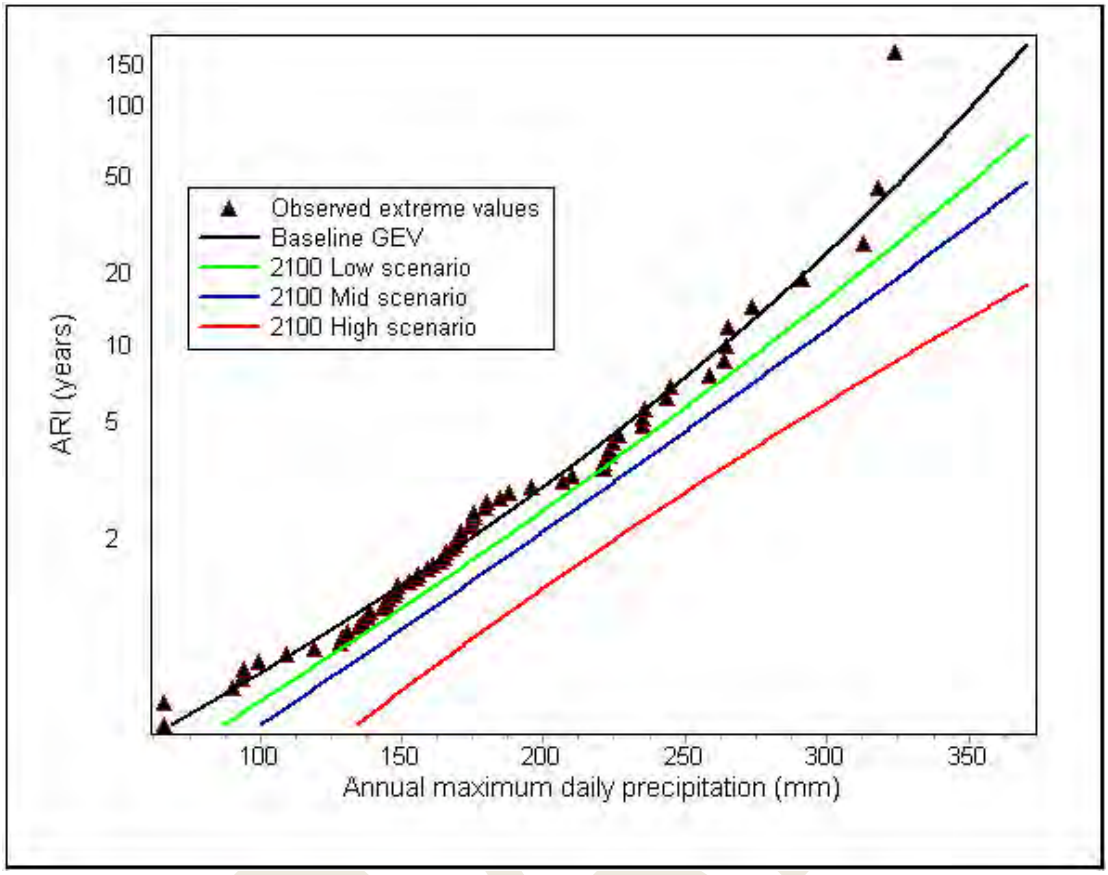


Figure 9: Climate change impact on Longzhou annual maximum daily rainfall

F.3 Sea level change projections

39. The sea level change scenario was based on a model ensemble of 24 GCMs sea level simulations. The first step was to construct the normalised change pattern, as expressed as sea level change per 1 cm global sea level rise (unit: cm/cm). Again the median value from the model ensemble was used as the 'best guess' of the future sea level change for a given location. Figure 10 demonstrates the normalised pattern based on RCP6.0 for the South China Sea. The sea level rise rate of Beibu Gulf is 1.16 cm/cm that is lower than the coastal area of neighbouring Guangdong Province, perhaps due to the protection from the surrounding land mass, particularly the Hainan Island and Leizhou Peninsula in the south. Table 6 lists the projection and uncertainty range of the sea level change of Beibu Gulf. According to the mid scenario projection, the sea level of Beibu Gulf is likely to increase about 25 cm by 2050 and 64 cm by 2100, which is a substantial rise.

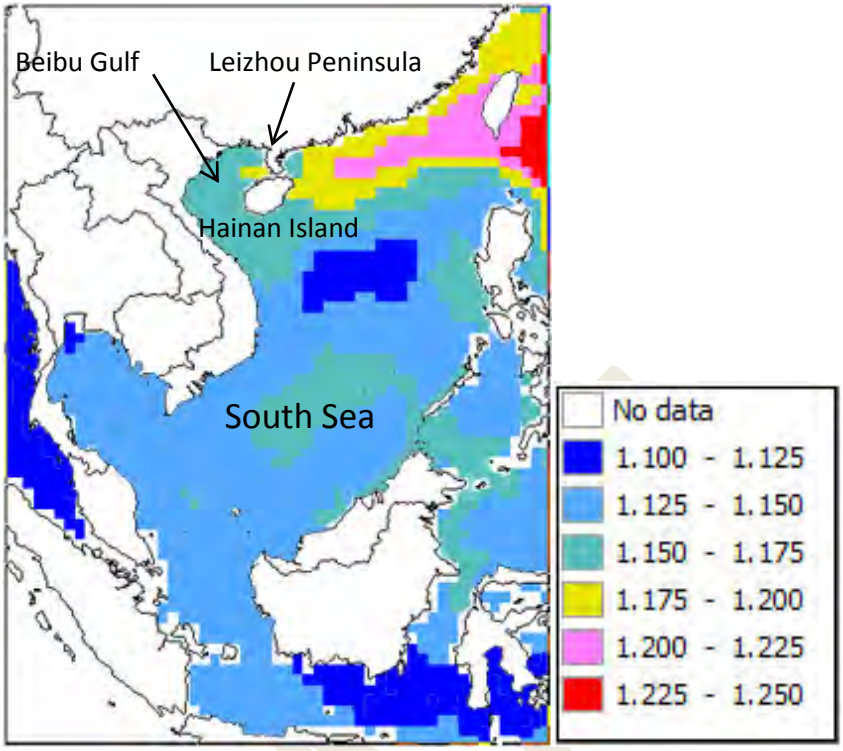


Figure 10: Normalised change pattern of sea level of South China Sea. (expressed as change per 1 cm global rise: cm/cm)

Table 6: Sea level change scenario of Beibu Gulf

	Climate sensitivity					
	Low	Mid	High	Low	Mid	High
	2050			2100		
RCP4.5	19.81	26.79	33.78	41.94	61.74	82.71
RCP6.0	18.64	25.63	32.62	44.27	64.07	85.04
RCP8.5	22.13	29.13	37.28	61.74	86.21	114.17

G. Climate change impact on Tranche1 subprojects and the implications for subproject design

40. Climate change information needs to be related to the subproject components in order to determine climate risk and how to address vulnerability. Tranche 1 subprojects have been decided with FSRs being completed so it was possible to carry out CRVA for these projects. There are 3 infrastructure subprojects in Tranche 1, namely ***Construction of Fangchenggang Training Center for Chinese and Vietnamese Workers and SMEs*** (Project 1 hereafter), the ***Development of Cross-border Labor Cooperation Demonstration Park in Pingxiang Border Economic Zone*** (Project 2 hereafter) and the ***Expansion of Pingxiang Border Trade Service Center*** (Project 3 hereafter). Project 1 is situated in the Gangkou District of Fengchenggang; Project 2 is located in Kafeng Village of prefectural level city of Pingxiang City of Chongzuo and Project 3 is located in Youyiguan Industrial Park of Xiashi Township of Pingxiang City in Chongzuo. The 3 subprojects are all situated on high ground. Project 1 is constructed on a hilly site with elevation varying from 13.25 to 114.30 metre above sea level (masl); Projects 2 and 3 have elevation all above 200 masl. There are no rivers close to the three projects. Project 1 is about 1 km away from the Beibu Gulf. Therefore they are not under threat from river flooding or sea storm surge.

41. Project 1 proposes construction of training facilities for auto repair, machinery, electronics, trade, and commerce. The infrastructure development includes three training buildings, a trainee/student dormitory, an information building, a canteen and a sports/leisure centre with a stadium. The total subproject area is 165000 m^2. The construction site is in a hilly area involving a great deal of slope cutting. The altitude varies from 13.25 to 114.30 masl. . The local geological conditions are characterised by serious rocky desertification. The steep slope of the landscape and the strong summer storm, as well as the unique geological conditions demand a careful rain water drainage design in order to prevent flash surface floods and soil/rock erosion. Although design work for most of the buildings has been finished, the rain water drainage design has not yet completed (pers. comm. with DI). According to Chinese national outdoor drainage design standard (GB50014-2006), the drainage capacity design is based on an empirical formula with the coefficients being determined from the historical annual maximum rainfall observations. Normally the maximum rainfall of 10 minute duration and 3 to 5 year ARI are used in drainage system design. However, no sub-daily data was available for this study. Only daily time series rainfall data was obtained for Qinzhou City, which is about 50 km northeast from the subproject site. Thus the climate change impact on the annual maximum daily rainfall of Qinzhou was used to investigate the sufficiency of the subproject drainage capacity design. As shown in Table 5, the mid-climate change scenario projects the intensity of the maximum daily rainfall of 5 year ARI increases 5.4% and 10.6% by 2050 and 2100 respectively at Qinzhou. **It is recommended that an 8% increase of rainfall intensity from the design standard is adopted in the subsequent detailed drainage system design.**

42. Project 2 include construction of a technical exchange center for employment and innovation, a training base, integrated service buildings and a dormitory area for staff. The total subproject area is 33267 m^2. Project 3 is an expansion of an existing border trade area. It is proposed to develop a declaring house, a warehouse, a comprehensive services building and other ancillary buildings. The subproject takes an area of 110443 m^2 of land, which has the surface already hardened (with concrete). It is in the north of the existing trade area, which has a total area about 40000 m^2. Projects 2 and 3 use the empirical storm intensity formula of Ningmin County in FSR design. Ningmin is about 18 km east of Project 2 and 35 km northeast of Project 3. The empirical formula can be expressed as:

$$q = \frac{4030 \times (1 + 0.62LgP)}{(t + 12.5)^{0.823}}$$

where, q is the designed rain water discharge capacity (L/(s·ha));
P is the design ARI (years); and
t is the rain water accumulation time duration (min).

43. According to national standards, 5 year ARI and 10 minutes of rain water collection duration is recommended in drainage system design, which gives rise to a designed rain water discharge capacity of 445 L/(s·ha).

44. No observed climate data was obtained for the 2 subproject sites. Longzhou is the closest station that has daily historical data available. Longzhou is about 25 km northwest of Project 2 and 35 km north of Project 3. Study was conducted for climate change impact on the annual maximum daily rainfall of Longzhou. As shown in Table 5, Longzhou annual maximum daily rainfall of 5 year ARI increases 6.5% and 12.8% by 2050 and 2100 respectively, as projected by the mid-climate change scenario. **It is recommended that a 10% increase of rainfall intensity from the design standard is adopted in the subsequent detailed drainage system design for the 2 subprojects.**

45. The heatwave hazard is also projected to increase significantly due to climate change. Heatwave is normally defined as a consecutive days of temperature above a given threshold. Human have developed different tolerance to heat from their long term living experience. Regional difference is a key feature in the relationship between heatwave and human. The impact of heatwave on human health should be determined based on effects to local people. Ye et al. (2013) studied the relationship of mortality and daily maximum temperature of the summer season for 753 stations over China, excluding the very cold area. Heatwave was defined as needing to satisfy 2 conditions: 1) the daily maximum temperature is higher than the 97th percentile of the local observed long term daily maximum temperature records; and 2) the duration is equal to or longer than the consecutive 6 days.

46. The baseline and future projection of the heatwave frequency and intensity was derived for the two stations based on such a definition, and the results are listed in Table 7. The frequency of heatwave is still rare in Tranche 1 subproject areas. It only happened once during a 64 year period (from 1952 to 2015) in Qinzhou and 3 times during a 63 year period (from 1953 to 2015). On average it is less than 2 times per 100 years for Qinzhou and 5 times per 100 years for Longzhou. Based on the mid-climate change scenario projection, by 2050 the heatwave frequency is likely to increase by almost 7 times from the baseline for the coastal city of Qinzhou, and 20 times for the inland Longzhou. It will likely become an annual event by 2100 for both cities. The intensity also increases. It changes from 7 days of baseline to 8 days by 2050 and 15 days by 2100 for Qinzhou, and increases from 8 days to 15 days and 17 days by 2050 and 2100 respectively for Longzhou.

Table 7: Heatwave: baseline and future projection

Station	Heat wave frequency (times/year)						
	Baseline	2050 scenario			2100 scenario		
		Low	Mid	High	Low	Mid	High
Qinzhou	1	5	9	80	9	66	533
Longzhou	3	13	23	87	23	78	476
	Heat intensity (the longest duration in days)						
Qinzhou	7	8	8	15	8	15	52
Longzhou	8	14	15	17	15	17	50

H. The adaptation options

47. Given the likely changing climate in the future, managing climate risks will require adoption of effective adaptation actions, in order to minimise future risks. Adaptation measures can alleviate vulnerability and reduce climate change impacts. This section discusses the adaptation options that have been identified based on literature review and from consulting with the staff of the PMO and the DIs:

H.1 "Hard" options: engineering measures in road system design and construction

48. Sufficient drainage capacity is critical to prevent urban flooding. According to the DIs, the drainage system design followed the general method of adopting an empirical formula from analysis of the historical observed storm event. Clearly the adequacy of the design requires examination given the climate change impact on rainfall. As discussed previously, the storm event of 5 years ARI would produce more rain water in the future. **For Project 1, it is recommended an 8% increase from the current standard to be adopted in the detailed drainage system design.** It is important to have a sufficient drainage capacity for this subproject, given its large elevation variation and soil erosion/rock desertification prone geology. **For the 2 subprojects in Pingxiang, Project 2 and Project 3 a 10% increase from the national standard should be used in the detailed drainage system design, i.e., the drainage system design should be based on 490 L/(s·ha), instead of national standard of 445 L/(s·ha).** The detailed drainage system design has not started for the 3 subprojects. An approximation was provided by DI that 8% to 10% drainage capacity increase would result in an additional cost of 10%. . Table 8 lists the estimation of additional cost of implementing adaptation by adjusting drainage system design.

Table 8: Estimation of additional construction cost of adjusting drainage system design

	Original cost CNY (000)	Additional cost CNY (000)	Additional cost to total cost ratio (%)
Project 1	7786	779	3.7
Project 2	1440	144	4.1
Project 3	1100	110	2.1

49. The heavy storm induced surface runoff is a major cause of soil erosion. If the frequency of heavy storm events increases there is also likely to be a higher risk of landslide. Project 1 is located in a hilly location, with substantial slope-land cutting and levelling. Steep slopes exist in many places inside the subproject area. It was understood from consultation with IA and DIs that engineering measures to stabilize the slopes have been designed. Project 3 is also being constructed on steeply sloping land on the north side, which the IA also indicated would be cut to a gentle slope to reduce landslide risk. The construction of slope stabilization is not include in the scope of the RCI program, but given the future increased landslide risk due to the heightened storm intensity, it is recommended that a higher design standard should be adopted for slope stabilisation.

50. Heatwave is still a rare event for the 3 subproject sites but it will very likely become more frequent and long lasting in the future. Potentially, heatwave may become a big health threat for people living/working in the subproject area. Through a comparison study of heatwaves of 1998

and 2003, Tan et al. (2007) conclude that mortality was strongly associated with the duration of the heatwave when it happens. However, the improvements in living conditions, such as increased use of air conditioning, larger living areas, and increased urban green space, along with higher levels of heat awareness and the implementation of a heat warning system, could significantly reduce the heatwave risk. Clearly, air conditioning is the most effective engineering measure against heatwave risk. According to the FSRs, no centralized air conditioning system was designed for the 3 subprojects. Only the staff living space of Project 1 is equipped with separated air conditioning units. The students or trainees may be required to undertake labor intensive activities; furthermore their dormitory is designed for 6 to 8 people per room, which is relatively crowded. Therefore, even though the air conditioning system may not be necessary for the current climate conditions, the future need should be considered and if necessary provisions included in the design, for example, adequate power supply and air conditioning facility space so a system can be installed easily at a future time when it becomes necessary. Building design should incorporate natural ventilation options and could specify materials for roofs and building envelope that reflect solar radiation rather than absorb it. Covered walkways that provide cover from rain and sun could also be considered. Through discussion with IA and DI, it was agreed that the above air conditioning option will be considered in detailed design, but the system will not be installed at this stage.

H.2 "Soft" measures: ecological solutions, management options

51. Resilience can also be strengthened through non-engineering measures. Good vegetation cover has proven to be effective in preventing soil erosion and landslide hazard. Guangxi has had serious soil erosion since 2000. During the 11 years of 2000 to 2011, the soil erosion area has trebled from 10690.50 km^2 to 50536.78 km^2 (Liang, 2014). Unsustainable agricultural practice and unprecedented infrastructure development have contributed to soil erosion problems, as a result of loss of vegetation cover and lack of management. Human induced soil erosion is still a serious issue in Guangxi (Liang, 2014). Strict soil and water erosion control and management measures should be implemented during the Tranche 1 subproject construction. Ecological restoration by planting native vegetation to create more green space helps stop soil erosion and should be implemented as much as possible in landscape planning and design. Soil and water resource protection through management and ecological restoration has fundamental importance in geological risk reduction such as landslide, and is an effective adaptation option to strengthen the project resilience to climate change impacts.

52. More green space created by good vegetation cover is also an effective option to reduce the heatwave risk to human health, as found by Tan et al (2007). Heatwave risk can also be managed through awareness raising of staff, students and trainees to enable preparedness in the event of a heatwave.

I. Conclusion

53. The future changing climate will have important implications for Guangxi RCI program. The RCI program area has already observed a warming trend and the temperature will likely continuously increase due to climate change impacts. According to the mid climate change scenario, the annual mean temperature was projected to increase about 1.2ºC and 2.3ºC by 2050 and 2100, respectively. Similar impacts are also expected for the maximum temperature, which is closely related to heatwave hazard. Climate change will also impact on future rainfall in the program area. For the northwest program area, the annual average rainfall was projected to increase about 2.0% and 4.0% by 2050 and 2100 respectively; and for the southeast, it is 3.8% and 7.4% by 2050 and 2100 respectively. Heavy storm events will likely be even more frequent and intense. For the coastal city of Qinzhou, the storm water amount is projected under a mid-climate change scenario to increase almost 6% and 12% by 2050 and 2100, respectively. The impact effects are more pronounced for the inland city of Longzhou, which is 6.94% and 13.52%, by 2050 and 2100, respectively. The increased storm volume indicates an exacerbated risk of surface flood and landslide hazards. Finally, the mid sea level change scenario projects that the average sea level of Beibu Gulf increases between 25 cm and 64 cm, by 2050 and 2100, respectively.

54. Several 'hard' adaptation options were identified in order to alleviate the climate change impacts. For Project 1, it is recommended that an 8% increase from the current standard is adopted in the detailed drainage system design. For the 2 subprojects in Pingxiang, a 10 % increase from the national standard should be used in the detailed drainage system design. For slope land stabilization engineering measures such as retaining walls and soft measures such as landscape planting are recommended to minimise risk of landslide damage. Heatwave is still a rare event currently, but has the potential to become a major climate hazard in the future. Air conditioning is the most effective engineering measure against the heatwave risk. It is recommended to have the buildings being heatwave ready through providing sufficient power supply and preparing space for future air-conditioning facilities. Provision of natural ventilation opportunities, use of solar reflective non-absorbent material in roof and building envelope specifications and provision of covered walkways should also be considered.

55. 'Soft' adaptation options have also been proven to be effective in reducing impact risk. Landslide risk is closely related with soil erosion. It has been found that human induced soil erosion has become a serious issue in the program area. In Tranche 1 subproject construction, strict soil erosion prevention measures should be implemented. Ecological restoration by planting native vegetation to create more green space helps stop soil erosion; and it also helps reducing heatwave risks. Awareness raising about the knowledge of heatwave, its risk to human health and ways to manage risks should be considered for the future during high heatwave risk periods.

56. This study was constrained by a number of limitations and could be improved if more supporting data was accessible. The following are the lists of some of the major limitations:

- The drainage capacity assessment was conducted on the basis of available data. Because storm drainage system design commonly makes use of sub-daily rainfall data, it would be ideal that the assessment could be conducted based on data that has the same temporal scale.
- The assessment is based on data close to the subproject sites, because climate data was not available for the subproject sites.

- The adaptation options discussed were presented as initial recommendations. No economic data was available to investigate the cost-benefit of implementing such adaptation options. However, we recommend selection of appropriate adaptations and/or their combination to be considered in subproject detailed design wherever feasible.

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Appendix 1: Climate Change Scenario generation

The uncertainties in climate change scenario generation

1. The future climate change projection includes uncertainties, particularly at the regional and local level. The major sources of uncertainties come from: 1) the difference of spatial change projections modelled by different GCMs; 2) the uncertainty in future atmospheric GHG concentration; and 3) the uncertainty results from limitations in the scientific understanding of the response of the climate systems to radiative forcing. Different GCM models have different parameterisation due to the unknown or not fully understood mechanism and feedbacks in the climate systems. Consequently, there remain large differences between GCMs in their projections of global-mean temperature change. A thoroughly studied uncertainty by the scientific community is the difference in GCM model parameterisation, or the climate sensitivity. The climate sensitivity is conventionally defined as the equilibrium change in global mean surface temperature following a doubling of the atmospheric (equivalent) CO_2 concentration simulated by a GCM. It has been found that the uncertainty range is between 2.0°C to 4.5°C (Solomon et al., 2007).

2. To reflect the uncertainty of future GHG emission rates, a new process has been used for future global climate change projection since IPCC AR5. In this process, GHG emissions and socioeconomic scenarios are developed in parallel, building on different trajectories of radiative forcing over time to construct pathways (trajectories over time) of radiative forcing levels (or CO2-equivalent concentrations) that are both representative of the emissions scenario literature and span a wide space of resulting GHG concentrations that lead to clearly distinguishable climate futures. These radiative forcing trajectories were thus termed "Representative Concentration Pathways" (RCPs). A RCP was simulated in an Integrated Assessment model to provide one internally consistent plausible pathway of GHG emissions and land use change that leads to the specific radiative forcing target. The full set of RCPs spans the complete range of integrated assessment literature on emissions pathways and the radiative forcing targets are distinct enough to result in clearly different climate signals.

3. Thus a combination of different RCPs and climate sensitivities can be used to characterise future scenario that reflect the major uncertainties at the global scale. In this study, three RCPs are used to characterise the possible climate change scenario and uncertainty range, i.e., RCP4.5, RCP6.0 and RCP8.5, which are corresponding to a possible range of radiative forcing values in the year 2100 of 4.5, 6.0, and 8.5 W/m2, respectively. RCP6.0 with mid-climate sensitivity represents a middle range future change scenario. Similarly, RCP4.5 with low-climate sensitivity and RCP8.5 with high-climate sensitivity represents the low and high bound of the uncertainty range of future global change scenarios.

4. The General Circulation Model (GCM) is the most reliable tool in generating the future climate change scenarios at large to global scale. The third important uncertainty in climate change scenario generation is the difference between GCM simulations for given regions or locations. At the regional-to-local scale, the uncertainties expend in terms of the spatial patterns of climate changes. Given the current state of scientific understanding and limitations of GCMs in simulating the complex climate system, for any given region in the world, it is still not possible to single out a GCM that outperforms all other GCMs in future climate change projection. Future climate change projection based on the analysis of a large ensemble of GCM outputs is more appropriate than using any individual GCM outputs (Wilby et al. 2009). This is particularly important if such a projection is used for impact assessments; a large ensemble of GCM simulations can provide a reliable specification of the spread of possible regional changes by

including samples covering the widest possible range modelling uncertainties (Murphy et al. 2004, Sortberg and Kvamsto 2006, Murphy et al. 2007, Räisänen 2007). A single GCM projection of future climate made with even the most sophisticated GCM can be of limited use for impact assessment as it lacks the ability to provide information on the range of uncertainties. Within an ensemble approach; provided the members of the ensemble are independent, a larger ensemble size could lead to a more reliable statistical result (Sterl et al. 2007). In this study, the 50 percentile value from the model ensemble sample was used in generating future climate change projections.

The pattern scaling method

5. The pattern-scaling method (Santer ***et al***., 1990) is based on the theory that firstly, a simple climate model can accurately represent the global responses of a GCM, even when the response is non-linear (Raper et al. 2001), and secondly, a wide range of climatic variables represented by a GCM are a linear function of the global annual mean temperature change represented by the same GCM at different spatial and/or temporal scales (Mitchell, 2003, Whetton et al. 2005). Constructing climate change scenarios using the pattern-scaling method requires the following information:

a) regional patterns of changes in climate (e.g. for precipitation) by specified timeframe (e.g. month) from GCM results, which are normalized to give a spatial pattern of change per degree of global-mean temperature change;
b) time-dependent projections of global-mean temperature change projected by a selected RCP under a selected "climate sensitivities"
c) baseline climate variables derived from observational records.

6. In generating a "time-slice" scenario for a future year, the normalised pattern (a) is scaled by a time dependent projection of global-mean temperature change (b). The resultant scenario of climate change is then used to perturb the underlying observed spatial climatology (c) to give a "new" climate for the year in question. In this way, the three key uncertainties – the GCM spatial patterns of change, the future GHG emission rates and the climate sensitivity – can be treated independently and combined flexibly and quickly to produce future climate scenarios (as per Wigley, 2003).

7. The advantage of pattern-scaling method is that the three key uncertainties – the future radiative forcing, the climate sensitivity and the GCM projected change – can be treated independently and combined flexibly and quickly to produce future climate scenarios (Wigley, 2003), while the key assumption underline the pattern-scaling method is that, at first the RCPs can accurately represent the global responses of a GCM even when the response is non-linear (Raper et al, 2001); and secondly for a GCM, the change of its climatic variables are a linear function of its global annual mean temperature change at different spatial and/or temporal scales. The GCM models of the couple model intercomparsion project phase 5 (CMIP5) results, which was the data supporting the IPCC AR5, were included in in the model ensemble (see Appendix 2 for the GCM included). All 40 GCMs with monthly data outputs were used in spatial GCM scenario generation. The 20 GCMs that has daily GCM outputs were used in extreme rainfall value scenario construction. As pointed by Reichler and Kim (2008), the average of models' simulation of changes for a climate variable is normally used to capture the middle conditions, as that the average often agrees better with observed climate than any individual model estimates. However, it was found that, though all GCMs has reasonable agreement in climate simulation at global or large regional scale, the difference of GCMs results could be significantly large at local or small regional scale indicating a huge uncertainty at such spatial

scales. Furthermore, such uncertainty is not consistent; hence it is difficult to identify and eliminate certain GCMs from model ensemble. The one or two 'outlier' GCM results could generate very biased projection for the average value of the ensemble. In this study, the median of the model ensemble, instead of the average, was used in order to provide a "best estimate" scenario of future change It is worthwhile to note that we only use the median value in this study, mainly due to the relative small ensemble size. Ideally top and bottom percentiles should also be used to determine the high and low uncertainty range bounds, but for practical purposes of guidance for policy and action this often tends to expend the scenarios to the point of being unmanageable and/or unusable. Again this is particularly true given the relative small size of ensemble that is 40 monthly GCMs and 20 daily GCMs.

8. The pattern scaling method is also extended to analyse the climate change impact on climate variability, such as the extreme precipitation event. A general extreme value (GEV) function was applied to the daily precipitation data from historical observations and GCM outputs to derive precipitation intensity values. Similar to a normalised pattern for monthly precipitation, normalised patterns of a series of precipitation intensities, such as 20 year ARI maximum daily precipitation, are calculated for a GCM following the steps discussed previously. In generating the normalised patterns, the GCM simulated period of 1975 to 2005 was used as GCM baseline.

9. Out of the 40 GCMs 22 have their daily simulation outputs publically available (see Appendix 2). For the GCM with available daily data, a linear regression method was used to process them in order to derive the normalised pattern for the precipitation intensity series. A more detail discussion of the extreme precipitation change scenario generation can be found from Ye and Li (2011).

Appendix 2: IPCC AR5 GCMs used in this scenario generation and their horizontal and vertical resolutions. Models with daily data available are used for extreme rainfall event scenario generation, with sea level are used for sea level change scenario generation

Model label	Resolution (longitude°× latitude°)	Daily	Sea level	Institution
ACCESS1.0	1.875×1.25	No	No	Commonwealth Scientific and Industrial Research Organisation/Bureau of Meteorology (CSIRO-BOM) Australia
ACCESS1.3	1.875×1.25	Yes	No	Commonwealth Scientific and Industrial Research Organisation/Bureau of Meteorology (CSIRO-BOM) Australia
BCC-CSM1.1	2.8125×2.8125	No	Yes	Beijing Climate Center (BCC) China
BCC-CSM1.1(m)	2.8125×2.8125	No	Yes	Beijing Climate Center (BCC) China
BNU-ESM	2.8125×2.8125	No		Beijing Normal University (BNU) China
CanESM2	2.8125×2.8125	Yes	Yes	Canadian Centre for Climate Modelling and Analysis (CCCma) Canada
CCSM4	1.25×0.9375	Yes	Yes	National Center for Atmospheric Research (NCAR) USA
CESM1(BGC)	1.25×0.9375	Yes	No	National Center for Atmospheric Research (NCAR) USA
CESM1(CAM5)	1.25×0.9375	No	No	National Center for Atmospheric Research (NCAR) USA
CMCC-CM	0.75×0.75	Yes	Yes	Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC) Italy
CMCC-CMS	1.875×1.875	Yes	Yes	Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC) Italy
CNRM-CM5	1.4×1.4	Yes	Yes	Centre National de Recherches Météorologiques (CNRM-CERFACS) France
CSIRO-Mk3.6.0	1.875×1.875	Yes	Yes	Commonwealth Scientific and Industrial Research Organisation (CSIRO) Australia
EC-EARTH	1.125×1.125	No	No	EC-EARTH consortium published at Irish Centre for High-End Computing (ICHEC) Netherlands/Ireland
FGOALS-g2	2.81x1.66	No	No	Institute of Atmospheric Physics, Chinese Academy of Sciences(LSAG-CESS) China
FGOALS-s2	2.81x1.66	No	No	Institute of Atmospheric Physics, Chinese Academy of Sciences(LSAG-IAP) China
GFDL-CM3	2.5 × 2.0	No	Yes	Geophysical Fluid Dynamics Laboratory (GFDL) USA
GFDL-ESM2G	2.5x2.0	Yes	Yes	Geophysical Fluid Dynamics Laboratory (GFDL) USA
GFDL-ESM2M	2.5x2.0	Yes	Yes	Geophysical Fluid Dynamics Laboratory (GFDL)

				USA
GISS-E2-H	2.5×2×L40	No	Yes	NASA Goddard Institute for Space Studies (NASA-GISS) USA
GISS-E2-H-CC	2.5×2×L40	No	No	NASA Goddard Institute for Space Studies (NASA-GISS) USA
GISS-E2-R	2.5×2×L40	No	Yes	NASA Goddard Institute for Space Studies (NASA-GISS) USA
GISS-E2-R-CC	2.5x2×L40	No	Yes	NASA Goddard Institute for Space Studies (NASA-GISS) USA
HadCM3	3.75x2.5	No	No	Met Office Hadley Centre (MOHC) UK
HadGEM2-AO	1.875 × 1.2413	No	No	National Institute of Meteorological Research, Korea Meteorological Administration (NIMR-KMA) South Korea
HadGEM2-CC	1.875 × 1.2413	No	Yes	Met Office Hadley Centre (MOHC) UK
HadGEM2-AO	1.875 × 1.2413	No	No	National Institute of Meteorological Research, Korea Meteorological Administration (NIMR-KMA) South Korea
HadGEM2-CC	1.875 × 1.2413	No	No	Met Office Hadley Centre (MOHC) UK
HadGEM2-ES	1.875 × 1.2413	Yes	Yes	Met Office Hadley Centre (MOHC) UK
INM-CM4	2x1.5	Yes	Yes	Russian Academy of Sciences, Institute of Numerical Mathematics (INM) Russia
IPSL-CM5A-LR	3.75x1.875	Yes	No	Institut Pierre Simon Laplace (IPSL) France
IPSL-CM5A-MR	2.5x1.25874	Yes	No	Institut Pierre Simon Laplace (IPSL) France
IPSL-CM5B-LR	3.75x1.875	Yes	No	Institut Pierre Simon Laplace (IPSL) France
MIROC-ESM	2.8125x2.8125	Yes	Yes	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology (MIROC) Japan
MIROC-ESM-CHEM	2.8125x2.8125	Yes	Yes	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology (MIROC) Japan
MIROC4h	0.5625x0.5625	No	No	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology (MIROC) Japan
MIROC5	1.40625 × 1.40625	Yes	Yes	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology (MIROC) Japan

MPI-ESM-LR	1.875x1.875	Yes	Yes	Max Planck Institute for Meteorology (MPI-M) Germany
MPI-ESM-MR	1.875 × 1.875	Yes	Yes	Max Planck Institute for Meteorology (MPI-M) Germany
MRI-CGCM3	1.125x1.125	Yes	Yes	Meteorological Research Institute (MRI) Japan
NorESM1-M	2.5x1.875	Yes	Yes	Bjerknes Centre for Climate Research, Norwegian Meteorological Institute (NCC) Norway
NorESM1-ME	2x2	No	Yes	Bjerknes Centre for Climate Research, Norwegian Meteorological Institute (NCC) Norway

Report on the Wildlife Trafficking Assessment of the Guangxi Zhuang Autonomous Region

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September 8, 2016

1. Border regions are widely considered to be a hotbed of illegal wildlife trade. Interviews and research in border regions of Guangxi Autonomous Region at the ports of Fangchenggang, Dongxing, Pingxiang and Longbang were carried out by ADB National Wildlife Trafficking Consultant in August 2016 to understand potential wildlife trafficking issues in the program area.

Key findings:

2. Firstly, no store or vendor was found to be engaging in public sale of wild animals and plants or associated products; however, there was sale of wild ducks and small sharks in the "Ronggu Supermarket", which vendors claimed to be commercially bred.

3. Secondly, during the investigation in Dongxing, it was established that the Beilun River is the most important smuggling route in Dongxing. It is a boundary river between the cities of Dongxing in PRC and Moncay in Viet Nam. The region along the Beilun River has become an important doorway for smuggling activities. Although the entire region of the Beilun River is surrounded by guardrails, there are still a few places which allow people to pass or climb over, and there are a lot of people that travel back and forth along the river by boat after climbing over the guardrails, as shown in picture 1, which shows an area where 20 to 30 people had crossed the guardrail back and forth in an hour. Some people from Viet Nam, wearing baseball caps, carrying snakeskin bags, quickly ran away after going ashore, and then were picked up by someone else and left by a motorbike. Given the rampant smuggling activities during the day, we believe that the condition would be worse at night.

Picture 1. An Illegal Exit and Entry Site along the Beilun River at Dongxing

4. In addition, along the Beilun River, there are many handicraft shops and redwood furniture stores. After investigating, it was found that there are 6 stores engaging in display and public sale of ivory products, and that they just display one or two products at the corner, but after asking the vendors, they can show you much more than those on display; besides, the prices of the ivory products here are generally slightly lower than those in the illegal markets of other cities in China. Besides, there are also water deer (***Rusa unicolor***, 2nd class national protected

species/CITES Appendix I) heads, Tibetan antelope (***Pantholops hodgsonii***, 1st class national protected species/CITES Appendix I) horns sold in the market (Picture 2).

5. In the Dongxing International Trade Market, we have also found some vendors selling live wild animals, most of them being wild birds (like Reded Feet Amaurornis phoenicurus, IUCN LC), Testudinates, frogs and snakes (like mud snakes, species unknown, IUCN LC). According to these vendors, there were mainly Elongated tortoises (Indotestudo elongate, CITES Appendix II), golden head tortoises (Cuora spp, CITES Appendix II), forest tortoises (species unknown), chelydra serpentines (IUCN, LC) and so forth. (Picture 3)

6. Not far from the port of Dongxing, stores along the street are mainly engaging in selling redwood furniture, which is a protected species Dalbergia cochinchinensisin (Siam Rosewood), as well as Pterocarpus santalinus (Red Sandalwood). Given that the size of redwood furniture markets in Dongxing are far smaller than those in Pingxiang, further investigations on wood focused on markets in Pingxiang.

Picture 2. Wild Animal and Plant Products

Picture 3. Live Wild Animals for Sale

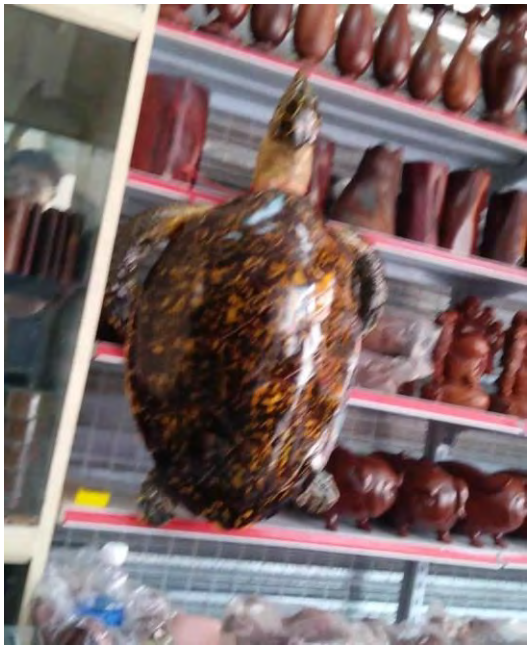
7. Thirdly, focused investigation was carried out of redwood markets in the urban area of Pingxiang and in Puzhai port. In terms of those in the urban area of Pingxiang, their business is relatively slow with a few customers and a lot of shops closed. Through interview and investigation, it was determined that the panels for sale in the redwood markets of Pingxiang, range from high to lower end quality and originate from a number of species, including Fragrant rosewood (***Dalbergia odorifera***), Red sandalwood (Pterocarpus santalinus lobular) Siamese rosewood (***Dalbergia cochinchinensisin***), and Myanmar padauk (***Pterocarpus macrocarpus***). There was also some redwood furniture which was not made from national protected species. Further detailed research on them. Fragrant rosewood (***Dalbergia odorifera***) is a Class 2 wild plant under national protection. Red Sandalwood and Siamese Rosewood are listed on CITES Appendix II[1]; and the Myanmar chrysanthemum (***pterocarpus macrocarpus***) is temporarily not on the list of the protected species. In term of quantity, the chrysanthemum (***dalbergia odorifera***) is so fewer that it is the most expensive one; the ***pterocarpus santalinuslobular*** rosewood is seldom used to make large furniture, and is mainly used to make crafts and strings; at present, the relatively popular material is the Siam rosewood (***dalbergia cochinchinensisin***), with rising price; however, according to the research, this material is in short supply in the market, because Viet Nam has put a restriction on the export of Siamese rosewood (***dalbergia cochinchinensisin***). Some vendors told us that they cannot get the material from Viet Nam even if they already put in orders.

8. It is found that furniture made from Siamese rosewood and ***Pterocarpus santalinus*** have no CITES certificate either, with local governmental agency issued "three yellow certificates" only (namely, product specification, product quality inspection book and product certification).

9. The markets along the Zhaipu Port are primarily engaging in crafts, mainly involves such protected species as the chrysanthemum (dalbergia odorifera) and the pterocarpus santalinuslobular rosewood. In addition, there are at least four other stores displaying and selling ivory products, and one displaying five pieces of hawksbill specimen.

Picture 4. Some Protected Species are Publicly Sold

[1] CITES Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. International trade in specimens of Appendix-II species may be authorized by the granting of an export permit or re-export certificate. Permits or certificates should only be granted if the relevant authorities are satisfied that certain conditions are met, above all that trade will not be detrimental to the survival of the species in the wild. https://cites.org/eng/app/index.php



Picture 5 Specimens of Hawksbill Turtle

10. Fourthly, because of some reason, the port of Longbang kept closing, and there were no vendors around the port, so no relevant information was available there.

Recommendations:

11. According to our rapid assessment in the region, Guangxi is a major wildlife trafficking destination between China and Viet Nam. The following recommendations are made based on our findings:

(i) ADB and its PRC partners should consider investing funding to provide cross-boundary wildlife enforcement training courses in the region alongside the ADB project to build capacity and enforcement to address wildlife trafficking issues.

(ii) Wildlife law enforcement authorities should be incorporated into the joint-agency checkpoints along the border between China and Viet Nam to enable checking of wildlife products at the ports. Awareness of domestic (e.g. China Wildlife Protected Law) and international (e.g. CITES) wildlife laws and punishments should also be directed to related governmental agencies and private sectors in the project region.

(iii) Joint efforts between China and Viet Nam should be facilitated by ADB and its parties in the province to set up periodic dialogue and a collaboration mechanism on combating illegal wildlife trade in the region;

(iv) Various organizations including CITES Management Authority Nanning Office, Guangxi Customs, Forest Police and Provincial Anti-smuggling Office etc., governmental enforcement agencies, as well as civil society including Wildlife Conservation Society-PRC Office, International Fund for Animal Welfare-PRC Office, Beijing Normal University, those who have been working on combating illegal wildlife trade and wildlife enforcement capacity building could be potential partners for ADB and its PRC counterparts to address wildlife trafficking issues in the region during/after the project period.