Initial Environmental Examination

July 2018

Viet Nam: Secondary Green Cities Development Project

Prepared by Provincial Peoples Committees of Thua Thien Hue, Ha Giang, and Vinh Phuc for the Asian Development Bank. This is an updated version of the document originally posted in April 2017 available on https://www.adb.org/projects/47274-003/main#project-documents.

ABBREVIATIONS

ADB	-	Asian Development Bank
PAH	-	Project Affected Household
BOD	-	Biological Oxygen Demand
CEMP	-	Construction Environmental Management Plan
COD	-	Chemical Oxygen Demand
DANIDA	-	Denmark International Development Agency
EPP	-	Environmental Protection Plan
HCPC	-	Ha Giang City Peoples Committee
HDPI	-	Thua Thien Hue Provincial Department of Planning and Investment
HMCC	-	Hue Monuments Conservation Center
HPPC	-	Ha Giang Provincial Peoples Committee
HUPPC	-	Thua Thien Hue Provincial Peoples Committee
DARD	-	Department of Agriculture and Rural Development
DOC	-	Department of Construction
DOLISA	-	Department of Labour, Invalids, and Social Assistance
DONRE	-	Department of Environment and Natural Resources
DPI	-	Department of Planning and Investment
EA	-	Executing Agency
EIA	-	Environment Impact Assessment
EMP	-	Environment Management Plan
EO	-	Environmental Officer
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IES	-	International Environment Specialist
GCAP	-	Green City Action Plan
GRM	-	Grievance Redress Mechanism
NES	-	National Environment Specialist
PMU	-	Project Implementation Unit
GOV	-	Government of Viet Nam
PMCS	-	Project Management & Consultant Supervision
PPC	-	Provincial Peoples Committee
PPTA	-	Project Preparation Technical Assistance
SGCDP	-	Secondary Green Cities Development Project
SO	-	Safeguards Officer
UXO	-	Unexploded Ordnance
VPMO	-	Vinh Phuc ODA Management Office
VPPC	-	Vinh Phuc Provincial Peoples Committee
WWTP	-	Wastewater Treatment Plant

WEIGHTS AND MEASURES

km	kilometre
kg	kilogram
ha	hectare
m	metre
mm	millimeter
C^o	degree celsius

NOTE

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

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the "terms of use" section on ADB's website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

EXECUTIVE SUMMARY

The Secondary Cities Development Project (Green Cities) will develop small-scale "green" and climate resilient infrastructure in the cities of Hue, Ha Giang, and Vinh Yen in Viet Nam to strengthen socioeconomic development in the three urban areas. The Secondary Cities Development Project (SCDP) was designed under PPTA 8671–VIE in 2016 in support of the Green Cities Action Plans that have been developed for each city as part of the Gr*EEE*n Cities Operational Framework for Integrated Urban Development in Southeast Asia[1]. Climate change resilience is explicit in the subproject designs due to the strong sensitivities of the three cities to existing climate/weather extremes.

Under the PPTA 8671-VIE, the SCDP was designed for a Results Based Lending (RBL) loan modality which deferred execution and responsibility for conducting the environmental due diligence of the SCDP to the program owners and executive agencies of the SCDP. The project owners are the Provincial Peoples Committees (PPC) of the provinces of Thua Thien Hue, Ha Giang, and Vin Yen.

Late in 2016 the loan modality of the SCDP was changed from an RBL to a standard investment loan. The change in loan modality, *inter alia,* required that a project level Initial Environmental Examination (IEE) of the SCDP be prepared, pursuant to the requirements of ADB's Safeguard Policy Statement (SPS 2009). As part of the IEE individual Environmental Management Plans (EMP) of each of the subproject cities were prepared.

In April 2017, an IEE including three EMPs for the three project provinces (Ha Giang, Hue and Vinh Yen) was cleared by ADB. However, the preparation of the original IEE and EMPs was based on the project Feasibility Study (FS). Since then, detailed design was initiated. Dtailed design may partly differ from preliminary design. This design adjustments may have environmental safeguard implications that need to be addressed – thus the need to review and update, as needed, the original IEE and EMPs to ensure the subprojects comply with the ADB Safeguards Policy Statement (2009). This updated IEE is based on, and reflects the final detailed design including supplementary assessments, measures for arising environmental issues from the detailed design.

The Viet Nam's Socio-Economic Development Strategy, 2011–2020 emphasized the need to sustain the rate of its economic growth while achieving social inclusiveness and environmental protection. This has led to the formulation of the National Program on Urban Development, 2012–2020, that requires efficient, sustainable and equitable urbanization.[2] However, secondary cities face limited financial resources and constrained local investment due to limited basic urban infrastructures and services.[3] Infrastructure development still needs to rely heavily on public investments: because of their limited size coverage cannot support economies of scale, and insufficient cost recovery. Their limited capacity to plan, design and prioritize investments also prevents efficient use of public funds and application of innovative ideas.

In 2013, Asian Development Bank (ADB) started a policy dialogue with the Vietnamese government by providing a capacity development technical assistance (CDTA) to support

[1] ADB. 2014. *Hue GrEEEn City Action Plan*. Manila; ADB. 2014. *Vinh Yen GrEEEn City Action Plan*. Manila.

[2] Prime Minister's Decision 445/2009. *Orientation Master Plan for Viet Nam Urban System Development to 2025 with a vision to 2050*. Viet Nam.

[3] The recent government's financial decentralization policy made many local governments confront large financial deficits due to reduced fiscal budget transfers and limited means of generating the fiscal revenue. Only 13 out of 63 centrally administrated cities and provinces are net contributors to the Viet Nam's central budget.

secondary cities for balancing economic growth and environmental sustainability to guide urbanization process.[4] The technical assistance selected Vinh Yen and Hue whose government expressed strong commitments. Ha Giang was added, thereby 3 cities collectively represent different socio-economic characteristics, development constraints, sector priorities and geographical locations.[5] In 2014–2015, a "GrEEEn" city action plan (GCAP) for each city was completed and endorsed by the government to mainstream an integrated urban planning incorporating climate change adaptation and mitigation, prioritize investments and propose greener solutions.[6] The proposed project will provide much needed investment in this three cities.

Vinh Yen, the capital of Vinh Phuc Province, is one of Ha Noi's satellite cities forming the greater Ha Noi city cluster. Due to its strategic location, the city is endowed with growth led by automobile manufacturing industries. However the city's development is largely influenced by Ha Noi and surrounding provinces. Hue, the capital of Thua Thien Hue Province, is a historical tourism city facing a conflicting agenda of conservation and development constraint of basic urban infrastructure. Ha Giang, the capital of Ha Giang Province, is a border city located on the country's northern border with the People's Republic of China (PRC) and at the confluence of the Mien River and Lo River. The landlocked city fails to benefit from its strategic location and rich natural resources, and remains economically isolated.

The thirty three (33) subproject components of the three subproject cities are listed in the tables below in which the component for rehabilitating street light system of Ha Giang City is added to Ha Giang subproject by Decision No.450/QD-UBND dated 23 March 2017 issued by Ha Giang Province People Committee.

Hue Subproject Components

Green and Climate Resilient Urban Development	
Citadel Protection and Environmental Improvement	• Drainage and Pavement in 4 Inner City Wards • Dredging and Embankment of Lakes
Resilient Water Environment and Infrastructure Development	• Dredging and Embankment of Ke Van River • Dredging and Embankment of An Hoa River • Dredging and Embankment of Dong Ba River • Dredging and Embankment of Lap River • Rehabilitation and Embankment of Nhu Y River • Rehabilitation and Embankment of An Cuu River • Water Supply to Pho Son Villages and Municipal Solid Waste Treatment Facility
Landscaping and Public Green Space	• Park, Path, Drainage and Lighting • Park and Square in the Administrative Area
Integrated Urban Road Network and Tourist Access Improvement	
Tourist Access Improvement	• Bui Thi Xuan Road • Huyen Tran Cong Chua Road
Road Connectivity Improvement	• Bridge connecting Area A and B of the An Van Duong Development Areas

[4] ADB. 2012. *Technical Assistance Report: Green Cities–A Sustainable Urban Future in Southeast Asia*. Manila. The TA promoted the "GrEEEn city" approach that enables cities to "economically competitive", "environmentally sustainable", "(socially) equitable" and increased risk of climate change and natural disasters.

[5] Ha Giang was supported by TA: ADB. 2012.*Secondary Cities Development Program (Green Cities)*. Manila

[6] ADB. 2014. *Hue GrEEEn City Action Plan*. Manila; ADB. 2014. *Vinh Yen GrEEEn City Action Plan*. Manila

	• Vy Da Bridge Expansion and Access Road

Ha Giang Subproject Components

Green and Climate Resilient Urban Development	
Drainage Channel Improvement and Environmental Rehabilitation	• Rehabilitation of Main Drainage Lines in Minh Khai Ward • Rehabilitation of Main Drainage Lines in Tran Phu Ward • Rehabilitation of Main Drainage Lines in Quang Trung Ward • Rehabilitation of Main Drainage Lines in Nguyen Trai Ward • Rehabilitation of Street Lighting System of Ha Giang City[7]
River Embankment Protection and Ecological Upgrading	• Western Embankment of Lo River • Embankment on each side of Mien River • Southern Embankment of Me Stream
Integrated Urban Road Network Development	
Urban Road Connectivity Improvement	• New Road on the East bank of Mien River (Phung Hung Road) • Southern Ring Road • New Bridge from National Road No.2 to Southern Ring Road • Upgrading of National Road No.2

Vinh Yen Subproject Components

Green and Resilient Urban Space Improvement
• Dredging and Landscape Protection of Dam Vac Lake
• Collection and Wastewater Treatment in Three Wards of Dong Tam, Hoi Hop and Tich Son
• Strengthening Collection Efficiency of Existing Drainage and Wastewater System in Four Wards of Dong Da, Ngo Quyen, Khai Quang and Lien Bao
• Green Park Development South of Dam Vac Lake
Economically Competitive City Development
• Infrastructure for University Area
• Exhibition/Linkage Center for Business Support

Benefits of Subprojects

The project supports the government's urbanization efforts and is aligned with the ADB's country partnership strategy 2016–2020. It is consistent with ADB's urban operational plan and environment operational directions by promoting, competitive, inclusive, and green growth; better quality of life by developing livable and climate resilience city.[8]

The project will benefit approximately 125,000 households, including 25,300 households in Vinh Yen, 87,000 households in Hue and 14,600 households in Ha Giang, including about 6,000 poor

[7] *The steet lighting component is added to Ha Giang subproject by the decision No.450 dated 23 March 2017 of Ha Giang Province People Committee*

[8] ADB. 2016. *Country Operations Business Plan, 2017–2019, Viet Nam*. Manila; ADB. 2016. *Country Partnership Strategy, 2016–2020: Viet Nam*. Manila; ADB. 2013. *Urban Operational Plan*, 2012–2020. Manila; ADB. 2013. *Environment Operational Directions, 2013–2020*. Manila.

and near poor households. The overall project social impacts will be positive and contribute to improving the quality of life of the people in Vinh Yen, Hue and Ha Giang. The project will improve the resilience of vulnerable groups and alleviate poverty through improvements in access to climate resilient urban environmental services; enable community-level groups to participate in the GCAP planning, implementation and monitoring processes.

(A) Green and Climate Resilient Urban Development

Embankment Developments & Dredging. Dredging of the different lakes and rivers of Hue and Vinh Yen will result in improved water quality. The improved water quality will increase dissolved oxygen which in turn will enhance animal and plant habitat in the lakes of the Citadel in Hue in particular. Flow through the rivers and canals will be improved during rainfall events, and existing capacity for navigation in the rivers and canals will increase.

The new and rehabilitated, landscaped river and lake embankments in Hue, Ha Giang, and Vinh Yen with stabilize the embankments by preventing erosion and slumping. In particular will be the impact of the new embankment sections planned for the erosion zones of the Nhu Y River in Hue and along sections of the Lo and Mien Rivers in Ha Giang. The heightened embankments around the lakes of the Citadel will increase storage capacity of the lakes during heavy rainfall events thereby reducing present local flooding, and from projected increases in rainfall from climate change. The treed and vegetated embankments will provide extensive linear green space promenades for local residents while also contributing to erosion control.

Parkland Developments. The green parks that will be developed in An Duong in Hue and at the south end of Dam Vac Lake in Vinh Yen will provide extensive community green space for recreation and leisure activities, and will provide natural surfaces for rainfall infiltration and local aquifer recharge. The large park areas will also seed associated small commercial business to support the new recreation and leisure activities which will act to strengthen local economies.

Stream-drainage Upgrades. Rehabilitation and removal of debris from the mostly vegetated stream-drains in Ha Giang will help to restore the natural flow of the streams, and prevent local flooding from debris-blocked stream sections. While placement of some concrete box culverts are needed to direct flow and curb erosion especially at the outfalls to the Lo and Mien Rivers, restoration of existing vegetated embankments will increase to natural capacity and function of the streams to moderate flood waters from heavy rainfall events, and to accommodate increases in rainfall intensity expected from climate change.

New Wastewater Networks & Treatment, and Water Supply. Expansion of the wastewater collection network and treatment capacity in Vinh Yen will immediately raise household standard of resident living while also broadly increasing the environmental quality of the urban area. The reductions in total domestic waste organic load to Dam Vac Lake and Phan River will increase water quality in these two major green-environment areas of the city, and contribute greatly to the overall success of the new Green Park that will be constructed at the south shore of the lake. The decrease in organic pollution loads to Dam Vac Lake and Phan River will offset the impact on water quality of potentially lower dry season lake and river levels which are projected from climate change. Similarly, the provision of a potable water supply to villages south of Hue will raise the standard of living while augmenting low groundwater yields during the dry season which may become more severe from climate change.

Street light improvement. Rehabilitation and removal of old high-pressure sodium lights and replace them with LED street lights. LED street lights are very energy efficient, have long life

spans (over 20 years), and produce better color and light quality than typical High Pressure Sodium (HPS) street lights. The LED street light retrofit component will result in (i) more even and efficient distribution of light and better quality of light resulting in increased safety; (ii) reduced energy consumption resulting in energy savings and reduced greenhouse gas emissions; and (iii) reduced outages and longer light life spans resulting in reduced maintenance costs.

(B) Integrated Urban Road Networks and Tourist Access Development

The new and upgraded roads and bridges in Vinh Yen, Ha Giang and Hue will improve traffic flow, reduce congestion, and indirectly strengthen local economies and diversify cultural development in the three cities. In particular are the benefits from tourism and University development from the three road developments in Hue and Vinh Yen. The upgrades to pavements and lateral drainage capacity of select streets in the Citadel in Hue will reduce local flooding. The integration of bioswales into the head of all drainage systems of the roads and embankments will both significantly green the street and landscape, and moderate runoff.

Impacts of Subprojects

The SCDP is Category B for environment. The potential impacts of the subproject components will not affect sensitive ecological or cultural resources, are not significant, and most are reversible. The SCDP was classed as *highly sensitive* to climate change. Domestic environmental impact assessments were prepared for all project components and approved by relevant provincial environmental protection authorities. A description of city-specific environmental sensitivities and domestic environmental assessments are described below.

In **Hue**, the proposed infrastructure components trigger ADB's environmental safeguards, as these will involve urban infrastructure for flood management; urban connectivity improvements and water supply. Except for the proposed channel dredging, drainage, pond and pavement rehabilitation works within and around the Hue Citadel[9], all components are outside environmentally sensitive areas. None of the components will encroach on any of the heritage sites listed in the Complex of Hue Monuments. Components in and around the Citadel target the rehabilitation and preservation of key environmental assets (riverfront, ponds, and lakes). Components classifying as category A for environment were excluded from the project scope.[10] For other components, the most sensitive sites are the rivers and canals that will be dredged and/or whose banks will be stabilized and/or crossed by bridge and road works. A domestic environmental impact assessment was prepared by a national EIA institute and approved by the Hue Provincial Department of Natural Resources and Environment (DONRE).

In **Vinh Yen**, the proposed urban infrastructure components of the subproject trigger ADB's and Vietnamese environmental safeguards because the components consist of lake dredging and riverbank improvements, a new 6-km urban road, secondary and tertiary sewer system upgrading, and a new 5,000 m^3 wastewater treatment plant. Vinh Yen Province DONRE and Department of Agriculture and Rural Development (DARD) confirmed that components are not near, and will not affect environmental and cultural sensitive areas. The most sensitive environments are the Dam Vac Lake (affected by dredging activities and embankment rehabilitation works, and indirectly

[9] Hue Citadel, the Imperial City, and other monuments were collectively recognized by UNESCO in 1993 as a World Cultural Heritage.

[10] The originally proposed component to dredge the Citadel moat which would trigger category A as it encroaches on the core zone of the Hue Citadel will be deleted from Hue subproject.

receiving treated effluent from the proposed WWTP); and households adjacent to sewer installation works and road construction works. Five domestic environmental impact assessments (EIA) and one environmental protection plan (EPP, for the Industry Linkage Center) were prepared by a national EIA institute and approved by the Vinh Phuc DONRE in August 2016. The EIA for the new urban park was approved by MONRE in September 2016.

In **Ha Giang**, the proposed urban infrastructure components of the subproject trigger ADB's environmental safeguards because the components consist of drainage upgrades, riverbank improvements, and new and upgraded roads including a new bridge across the Lo River. All components are not near, and will not affect environmental and cultural sensitive areas. The most sensitive environments are the Lo, Mien, and Me Rivers, and adjacent homes. A domestic environmental impact assessment was prepared by a national EIA institute and approved by the Ha Giang DONRE.

The potential environmental impacts of the subproject components focus on the short-term construction phase-related impacts and disturbances. Resettlement and compensation for asset loss that will be required is described in detail in a separate inventory of Losses and Resettlement Plan.

Construction impacts. The IEE identified the lakes, rivers and canals that will be dredged and/or whose banks will be stabilized, as well as homes adjacent to project facilities as the most sensitive sites. No sub-component will encroach on legally protected sites. Impacts are anticipated to be confined within the components' immediate areas of influence, dredged material and waste disposal sites, and the routes to and from these sites. Potential impacts and disturbances of the various subproject components during construction consist of noise, dust, increased traffic congestion, reduced access, & increased risk of traffic accidents. Solid and domestic construction waste will need to be managed, as will the effects of embankment development and dredging on water quality (e.g., suspended sediment), and users of the water courses. Fishing, boat traffic, and aquaculture will be interrupted during construction phase. The bottom sediment of the lakes and rivers to be dredged is not contaminated so the large volumes of dredgate can be disposed easily in DONRE approved sites. However, dredgate from Dam Vac Lake will be used to infill the new green park at the end of the lake. The rehabilitation of the small mountain stream drains in Ha Giang will also generate suspended sediment in the streams.

The construction of the six subproject components in, and adjacent to the Citadel and other heritage sites listed in the Complex of Hue Monuments will need extra care to ensure the physical property and tourism within the Citadel and other sites of the Complex of Hue Monuments are not negatively affected or disrupted. The Hue Monuments Conservation Centre (HMCC), will be directly involved in the review and appraisal of detailed design. Designs will be submitted to the Vietnam National Commission for UNESCO in advance of decision-making to demonstrate accordance with the Management Plan of the Complex of Hue Monuments (2015). HMCC will also be involved in day-to-day supervision of construction disturbances such as traffic, noise, and dust, and scheduling construction activities. The HMCC confirmed the finding of this IEE that none of the proposed project sub-components will encroach on the core or buffer zone of any of the sites listed in the Complex of Hue Monuments.

Impacts during Operation. The project is not anticipated to generate significant adverse environmental impacts during operation. Cumulative greenhouse gas emissions generated from traffic on the subproject's roads are not expected to exceed ADB's threshold of 100,000 tons per year. The proposed wastewater treatment plant in Vinh Yen will reduce total pollution load to the Dam Vac Lake. The discharge of treated effluent is a new point-source of pollution, but is not

expected to significantly affect overall lake water quality. Regular monitoring of WWTP effluent and lake water quality within the mixing zone will be conducted.

Environmental management plans. Three Environmental Management Plans (EMP) have been prepared for the subproject cities which detail the standard construction management practices that are required to prevent or minimize impacts and disturbances. The mitigation plans of the EMPs prescribe special subplans for more sensitive areas such as the Citadel. The EMPs include an environmental monitoring program. The monitoring results will be used to evaluate (i) the extent and severity of actual environmental impacts against the predicted impacts, (ii) the performance of the environmental protection measures and compliance with relevant Vietnamese laws and regulations as well as internationally accepted standards as defined in the IFC Environment, Health and Safety Guidelines, (iii) trends of impacts, and (iv) overall effectiveness of the EMPs.
The finalized EMPs based on the detailed engineering design and cleared by ADB will form part of the bidding documents. Adherence to the EMPs will reduce residual impact significance to acceptable levels.

Environmental management arrangments. The three executing agencies, through their Project Management Units (PMUs), are responsible for overseeing the implementation of the EMPs. The capacity of the PMUs in Hue, Vinh Yen and Ha Giang to coordinate EMP implementation will be strengthened as follows:

(i) The PMUs will assign one full-time qualified staff to coordinate EMP implementation. The PMU environment staff will (i) review the site-specific construction EMPs (CEMPs) submitted by the contractors; (ii) supervise contractors and their compliance with their CEMPs; (iii) conduct regular site inspections; (iv) coordinate and act as local entry point for the grievance redress mechanism (GRM); (iv) coordinate implementation of the capacity building and training program related to environment; (v) prepare inputs to the quarterly project progress reports and (vi) coordinate the preparation of the semi-annual environment monitoring reports and submit them to ADB.

(ii) The initial project management startup consultant services will include an environment specialist to assist HDPI and HCPC in initial project implementation. The specialist will update the approved EMPs in Hue and Ha Giang based on final alignment of subproject components as a result of the detailed engineering design and submit to ADB for review and approval;

(iii) Qualified environment specialists will be recruited as part of the project management and construction supervision consultants (Hue, Ha Giang) and the safeguards and social monitoring consultants (Vinh Yen) to (i) provide training to the PMUs and contractors and establish city-level environmental management systems; (ii) supervise the implementation of EMPs; (iii) conduct environmental effect monitoring in compliance with the monitoring plan defined in the EMPs; (iv) prepare semi-annual environment monitoring reports for the provincial DONREs and ADB, as well as EIA completion reports for provincial DONREs; and (v) support the PMUs in addressing any environment related complaint in accordance with the grievance redress mechanism (GRM) defined in the EMP;

(iv) The contractors will be required to develop site-specific construction EMPs.[11] These shall be reviewed, cleared and monitored by the project implementation

[11] The need to comply with the EMP and to develop a construction EMP shall be defined in the bidding documents for all works packages.

consultants. The contractors will also conduct regular ambient monitoring of noise, air quality and surface water quality at construction site boundaries.

Cumulative and Induced Impacts. Potential cumulative impacts of the subproject subcomponents concern the impacts of multiple components on the same environment receptor such the potential impact three components of the Hue subproject on the Nhu Y River, and the impact of six clustered components on the Citadel in Hue. Conversely, potentially positive cumulative impacts on water quality and flood control will stem from the joint impacts of the SCDP and two external projects funded by DANIDA and the World Bank in Ha Giang and Vinh Yen. The planned components in Hue City are in line with the Management Plan of the Complex of Hue Monuments (2015). Improved road conditions supported by the project will improve access to heritage sites, which is a key development objective of the province and a objective of the Management Plan of the Complex of Hue Monuments (2015), and as such will not result in induced (unintended) impacts. A General Planning of Tourism Development in Thua Thien Hue Province for the period 2013 – 2030 was promulgated by Thua Thien Hue People Committee by Decision 1622/ QD-UBND. The General Planning defines objectives and forecast of specific targets and the orientation for tourism development in the province. HMCC developed a tourism plan as part of the Management Plan of the Complex of Hue Monuments (2015), which is being implemented since 2016. The impact of tourism activities and development of tourism infrastructure is monitored by HMCC on a six-monthly basis (as defined in the monitoring plan of the Management Plan of the Complex of Hue Monuments (2015). Monitoring results will be reported to ADB through the semi-annual monitoring reports.

Consultation, Grievance Redress Mechanism

Meaningful public consultation was conducted in the framework of the PPTA and this IEE. Stakeholders were identified and engaged in a participatory manner. Stakeholder consultations focused on interviews and initial consultations with resource management agencies. Issues and concerns identified by affected residents during the public consultations in the three cities include, concerns of increased traffic & traffic accidents, disruption of existing drainage leading to local flooding, noise and dust, construction phase being delayed and never on schedule, the need for information on construction scheduling, and new road and embankment alignments encroaching on property & and need for adequate compensation. All issues and concerns will be addressed by the EMPs. Plans for public involvement during construction and operation stages have been developed during project preparation. The VODA, the HDPI, and the HCPC, and their project management and construction supervision consultants (for HDPI and HCPC) and safeguards and social monitoring consultant (for VODA) are responsible for public participation during project implementation. These plans 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 project is completed. These plans will include several types of public involvement, including site visits, workshops, investigation of specific issues, interviews, and public hearings. Grievance redress mechanisms have been defined for each city.

Climate Change

The Project's **climate risk** without mitigation is classified as high. The three subprojects are highly sensitive to climate change due to their high sensitivities to present climate/weather extremes, and in the case of Hue, storm surge from the neighbouring Viet Nam sea. The project will significantly contribute to the cities' climate resilience by implementing key urban climate

resilience priorities identified in the Green City Action Plans (2014), the Climate Adaptation Action Plan for Vinh Phuc Province (2011-2020) and the Climate Action Plan for Hue City (2014-2020). Community-led climate resilience initiatives will be supported through the UCCRTF grant component of the project, targeting most vulnerable wards and communities in the three project cities. The large majority of subproject components have been designed to be resilient to climate change. Climate proofing ranges from elevated embankments, erosion resistant embankment materials and grades, drainage networks with increased and strengthened capacity for conveying runoff, and dredged lakes and rivers to improve flow and standing capacity. The contribution of the SCDP to climate finance has been estimated at $29.16 million. This excludes grant funding through the UCCRTF and GEF.

Conclusion

The SCDP will provide significant improvements to urban infrastructures of the three subproject cities. The explicit landscaped and “green” design elements will contribute greatly to the water management function of the infrastructures, while contributing the green city action plans of the cities. The SCDP will increase resilience to present climate/weather extremes, and to projected changes in local climate.

The description of the feasibility designs of the three subprojects combined with available information on the affected environments are sufficient to identify the scope of potential environmental impacts of the Project. Providing that significant changes do not occur to the design of one or more subproject components, and that new sensitive environmental or social receptor data are not discovered, the subprojects will remain Category B for environment and will not require further detailed environmental impact assessment (EIA). If at any point in the project the scope of works changes or unanticipated impacts on the Complex of Hue Monuments occur, the categorization will be revisited.

TABLE OF CONTENTS

Tables

Figures

ABBREVIATIONS

ADB	-	Asian Development Bank
PAH	-	Project Affected Household
BOD	-	Biological Oxygen Demand
CEMP	-	Construction Environmental Management Plan
COD	-	Chemical Oxygen Demand
DANIDA	-	Denmark International Development Agency
EPP	-	Environmental Protection Plan
HCPC	-	Ha Giang City Peoples Committee
HDPI	-	Thua Thien Hue Provincial Department of Planning and Investment
HMCC	-	Hue Monuments Conservation Center
HPPC	-	Ha Giang Provincial Peoples Committee
HUPPC	-	Thua Thien Hue Provincial Peoples Committee
DARD	-	Department of Agriculture and Rural Development
DOC	-	Department of Construction
DOLISA	-	Department of Labour, Invalids, and Social Assistance
DONRE	-	Department of Environment and Natural Resources
DPI	-	Department of Planning and Investment
EA	-	Executing Agency
EIA	-	Environment Impact Assessment
EMP	-	Environment Management Plan
EO	-	Environmental Officer
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IES	-	International Environment Specialist
GCAP	-	Green City Action Plan
GRM	-	Grievance Redress Mechanism
NES	-	National Environment Specialist
PMU	-	Project Implementation Unit
GOV	-	Government of Viet Nam
PMCS	-	Project Management & Consultant Supervision
PPC	-	Provincial Peoples Committee
PPTA	-	Project Preparation Technical Assistance
SCDP	-	Secondary Cities Development Program
SO	-	Safeguards Officer
UXO	-	Unexploded Ordnance
VODA	-	Vinh Phuc ODA Management Office
VPPC	-	Vinh Phuc Provincial Peoples Committee
WWTP	-	Wastewater Treatment Plant

WEIGHTS AND MEASURES

km	kilometre
kg	kilogram
ha	hectare
m	metre
mm	millimeter
C^o	degree celsius

I. INTRODUCTION

1. The Secondary Cities Development Program (Green Cities) will strengthen and develop small-scale infrastructure in the cities of Hue, Ha Giang, and Vinh Yen in Viet Nam for the goal of strengthening socioeconomic development in the three urban areas. The Secondary Cities Development Program (SCDP) was designed under PPTA 8671–VIE in 2016 in support of the Green Cities Action Plans[12] that have been developed for each city as part of the Gr*EEE*n Cities Operational Framework for Integrated Urban Development in Southeast Asia[13]. The extensive multi-volume PPTA report on the rationale and design of the SCDP in the three Viet Nam cities is found under separate cover[14].

A. Assessment Context

2. The initial rapid environmental assessment (REA) of the SCDP classified the Program as Category B for environment pursuant to ADB's Safeguard Policy Statement (SPS 2009). Potential impacts of the SCDP such as short-term construction disturbances, and altered traffic patterns, do not affect sensitive natural or cultural resources, are short-term, not unprecedented, and most are reversible.

3. Under the PPTA 8671-VIE, the SCDP was designed for a Results Based Lending (RBL) loan modality. Unlike a normal ADB investment loan, the RBL modality deferred execution and responsibility for conducting the environmental due diligence of the SCDP including completion of the environmental impact assessment that is required by the GoV and ADB's SPS 2009 to the Program owners and Executive Agencies (EA) of the SCDP. The project owners are the Provincial Peoples Committees (PPC) of the provinces of Thua Thien Hue, Ha Giang, and Vin Yen.

4. As part of RBL, a Program Safeguard Systems Assessment (PSSA) of the SCDP[15] was conducted to assist the EAs to ultimately conduct the environmental due diligence of their subproject cities to meet the EIA and safeguard requirements of the GoV and the SPS (2009). The PSSA assessed the equivalence of the GoV EIA system with the SPS (2009) to identify where the EAs need to supplement the GoV EIA requirements to meet the SPS (2009). To support and provide the basis for the PSSA a more detailed Assessment of the Environmental Safeguard System[16] (ESSA) of the SCDP was conducted.

5. Late in 2016 the loan modality of the SCDP was changed from an RBL to a standard investment loan. The change in loan modality, *inter alia,* required that a project level Initial Environmental Examination (IEE) of the SCDP be conducted pursuant to the requirements of SPS (2009). As part of the IEE, individual Environmental Management Plans (EMP) of each of the subproject cities were prepared.

[12] Separate Green City Actions Plans (GCAP) were developed for Hue, Ha Giang, and Vinh Yen.
[13] Chandhu and Singru, 2014. Enabling GrEEEn Cities: An operational Framework for Integrated Urban Development in Southeast Asia, Southeast Asia Working Paper #9, ADB.
[14] PPTA 8671-VIE. Secondary Cities Development (Green Cities) Project, Volumes 1-4, ADB.
[15] 2014. Program Safeguard Systems Assessment of the Secondary Cities Development Program (Green Cities), Socialist Republic of Viet Nam.
[16] PPTA 8671-VIE. Assessment of Environmental Safeguard System, Appendix 18, Volume 2.

6. In April 2017, an IEE including three EMPs for the three project provinces (Ha Giang, Hue and Vinh Yen) was cleared by ADB. However, the preparation of the original IEE and EMPs was based on the project Feasibility Study (FS). Since then, detailed design was initiated. Detailed design may partly differ from preliminary design. These design adjustments may have environmental safeguard implications that need to be addressed – thus the need to review and update, as relevant, the original IEE and EMPs to ensure the subprojects comply with the ADB Safeguards Policy Statement (2009). This updated IEE is based on, and reflects the final detailed design including supplementary assessments, measures for arising environmental issues from the detailed design.

7. Following the completion of PPTA 8671-VIE supplemental funding from the Climate Change Resilience Trust Fund (CCRTF) became available. The CCRTF will fund parallel, small scale Category C initiatives to develop resilience of the subproject communities to climate change. While Category C[17] projects do not require an IEE, the CCRTF initiative is included in the IEE to provide a guidance for selecting the "no impact" activities promoting climate change resilience.

B. Structure of Report

8. The original IEE supplemented the environmental impact assessment and safeguard work completed[18] for the SCDP, to complete the required environmental due diligence of Category B projects pursuant to the SPS (2009). The original IEE follows the content and structure of an IEE and EMP that is prescribed by Annex 1 of Appendix 1 of the SPS (2009). The updated IEE presented herein still keeps the structure and almost all of the content of the original IEE and only adds description of the changes from the completed detailed design as well as the change-related assessments to comply with the SPS.

9. The three city subprojects consist of a combined total of 33 proposed subproject components (the street lighting component has been supplemented into the Ha Giang subproject in March 2017 by the decision No.450 dated 23 March 2017 of Ha Giang Province People Committee). Because the SCDP consists of three separate subproject cities, three separate EMPs were prepared for the subproject cities in support of the IEE. The separate EMPs allow the project management units (PMUs) to focus on the environmental management of their subprojects in conjunction with the construction contractors and input from affected stakeholder. A key component of the EMPs are the roles and responsibilities for implementing the subproject EMP.

[17] Appendix 1 of SPS (2009)
[18] PPTA 8671-VIE. Volume 1, Chapter 4.5 + Supporting Appendices, Volume 2.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

10. The Secondary Cities Development Program will be implemented according to the directives set down for use of Official Development Assistance (ODA) by GoV Decree No. 38/2013/ND-CP of April 23rd 2013 on management and use of Official Development Assistance (ODA) and concessional loans of Donors, and in accordance with the provisions of the Project.

A. Viet Nam Regulatory Framework for Environmental Assessment

11. The recently revised Viet Nam Law on Environmental Protection No. 55/2014/QH13 (LEP 2014) prescribes the requirements for environmental assessment (EA) for development projects that affect the natural and social environments. Government Decree 18/2015/ND-CP (2015) and Circular 27/2015/BTNMT (2015) on environmental protection planning, strategic environmental assessment (SEA), and environmental impact assessment (EIA) support the implementation of the LEP (2014). Under GoV regulations the national environmental impact assessments (EIA) prepared for the three subprojects in Hue , Ha Giang, and Vinh Yen were approved by the respective provincial Departments of Natural Resources and Environment (DONRE) of Thua Thien Hue, Ha Giang, and Vinh Yen. The EIAs were approved by MONRE following Decision No.649/QD-BTNMT dated 27 March 2015 as required by the LEP (2014).

B. Environmental Laws, Policy, Environmental Standards, and Guidelines

12. The following are key legal directives for environmental assessment and protection in Viet Nam:

On Environment Protection

- Law on Environmental Protection No. 55/2014/QH13, passed by the National Assembly on 23th June 2014, in effect on January 01, 2015;
- Law on Water Resources No 17/2012/QH13;
- Law No 29/2004/QH11 on Forest Protection and Development, passed by the National Assembly on December 03, 2004, in effect on April 01, 2005;
- Biodiversity Law 20/2008/QH12 dated 13th November 2008;
- Decree No. 18/2015/ND-CP, dated February 14, 2015, on environmental protection planning, Regulating Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment;
- Decree No. *179/2013/ND-CP* dated November 14, *2013 of the Government*, on the sanction of administrative violations in the domain of environmental protection;
- Decree No. *32/2006/ND-CP of the Government*, on management of endangered, precious and rare forest plants and animals;
- Decree No. *23/2006/ND-CP* dated March 03, *2006* of the Government on the implementation of the law on forest protection and development.
- Decree No. *59/2007/ND-CP* dated April 09, *2007* of the Government on solid waste management.
- Decree No. *99/2010/ND-CP* dated September 24, *2010 of the Government*, on the policy on payment for forest environment services.
- Circular 27/2015/BTNMT, On Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Plans, date May 29, 2015.

- Circular No. *24/2013/TT-BNNPTNT* dated May 06, *2013 of the MARD*, provisions on replacement afforestation upon conversion of forest use purpose to other purposes.
- Circular No. *12/2011/TT-BTNMT* dated April 14, *2011* of the MoNRE, stipulating hazardous waste management.

On Land Management

- Land Law No. 45/2013/QH13, passed by the National Assembly dated November 29, 2013, in effect on July 01, 2014;
- Decree No. 43/2014/NĐ-CP dated May 15, 2014 of the Government, detailing implementing some articles of Land Law, in effect on July 01, 2014;
- Decree No. 47/2014/NĐ-CP dated May 15, 2014 of the Government, providing on compensation, support, resettlement when the State acquires land, in effect on July 01, 2014;
- Circular No. 37/2014/TT-BTNMT dated June 30, 2014 of the MONRE, providing details on compensation, support and resettlement when the State acquires land.

On Cultural Heritage Conservation and Tourism

- Law on Cultural Heritage No. 28/2001/QH10 dated June 29, 2001.
- Law on amendment and supplement of Law on Cultural Heritage (No.32/2009/QH12 dated June 18, 2009.
- Decree No. 98/2010/NĐ-CP dated September 21, 2010 of the Government that set the detailed regulations to implement the Law on Culture Heritage and Law on amendment and supplement of Law on Cultural Heritage.
- Law on Tourism No. 44/2005/QH11 dated June 14, 200).
- Decree No. 92/2007/ NĐ-CP dated June 1, 2007 by the government regulated the detail articles of Law on Tourism.
- Decree No. 180/2013/NĐ-CP dated November 14, 2013 by the government on the amendment and supplement the articles of Decree No. 92/2007/NĐ-CP dated June 1, 2007.
- Decision No. 1706/2001/QĐ-BVHTT dated July 24, 2001 by the Ministry of Culture, Sports and Tourism on approval of the General plan for the conservation and promotion of historical – cultural monuments and beautiful landscape's value until 2020.
- Decision No. 02/2003/QĐ-BTNMT dated July 29, 2003 by the Ministry of Resources and Environment on the regulation of environment protection in the field of tourism.
- Decision No. 86/2008/QĐ-BVHTTDL dated December 30, 2008 by the Cultural, Sports and Tourism Minister on the Regulations for the archaeological survey and excavation.

On Health and Safety

- Law on Occupational Health and Safety No. 84/2015/QH13;
- Law on Construction No.50/2014/QH13;
- Circular No. 22/2010/TT-BXD on labor safety in construction;
- Joint Circular No. 12/2012/TTLT-BLDTBXH-BYT guiding the statement, investigation, statistics and reports on occupational accidents.
- Law on fire prevention and fighting No. 27/2001/QH10 dated June 29, 2001;
- Law on amendment and supplement of Law on fire prevention and fighting No. 40/2013/QH13 dated November 22, 2013;

- Decree No. 79/2014/NĐ-CP dated July 31, 2014 by the Government that set the details to implement of Law on fire prevention and fighting, Law on amendment and supplement of Law on fire prevention and fighting;
- Law on Natural Disaster Prevention and Control No. 33/2013/QH13 dated June 19, 2013;
- Decree No. 66/2014/NĐ-CP dated July 4, 2014 by the government on the detailed regulations and direction to implement the articles of Law on Natural Disaster Prevention and Control.

Environmental Standards and Regulations

- Labour hygiene standards issued via Decision No. 3833//2002/QĐ-BYT dated October 10, 2002 of the Ministry of Health.
- QCVN 05:2013/BTNMT – National technical regulation on quality of ambient air.
- QCVN 26:2010/BTNMT – National technical regulation on noise.
- QCVN 27:2010/BTNMT – National technical regulation on vibration.
- QCVN 03:2008/BTNMT - National regulation on heavy metals concentrations in soil.
- QCVN 08:2008/BTNMT - National technical regulation on quality of surface water.
- QCVN 09:2008/BTNMT - National technical regulation on quality of groundwater.
- QCVN 14:2008/BTNMT - National technical regulation on quality of domestic wastewater.
- QCVN 40:2011/BTNMT- National technical regulation on industrial wastewater.
- TCVN 5948:1999. Acoustics. Noise generated by road traffic vehicles when increasing speed. Maximum allowable noise;
- TCVN 6438:2001: Maximum permitted emission limits of exhausted gases from vehicles.
- QCVN 01:2008/BCT: National technical regulation on electricity safety.

International Environmental Management Conventions

13. Viet Nam is signatory to the following relevant international conventions:

- 2009, Stockholm Convention on Protection of Human Health and the Environment from Persistent Organic Chemicals [including PCBs].
- 1971, Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar).
- 1982, Protocol to Amend the Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Paris.
- 1972, Convention for the Protection of the World Cultural and Natural Heritage (World Heritage Convention). [19]
- 1973, Convention on International Trade in Endangered Species Wild Fauna and Flora.
- 1985 FAO International Code of Conduct on the Distribution and Use of Pesticides.
- 1985 Vienna Convention for the Protection of the Ozone Layer.
- 1987 Montreal Protocol on Substances that Deplete the Ozone Layer.
- 1992, Copenhagen Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, Copenhagen.
- 1989, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
- 1992, United Nations Framework Convention on Climate Change.
- 1992, Convention on Biological Diversity.

[19] Viet Nam ratified the Convention in 1987. It is a legal document. The Operational Guidelines for the Implementation of the World Heritage Convention are revised from time to time, the latest revision being in 2013.

- 1993, Decision of the 17th session of the World Heritage which recognized the Complex of Huế Monuments as the World Cultural Heritage.

International Guidelines

- IFC/World Bank Group, 2007. Environmental Health and Safety Guidelines. General Guidelines. Wash. DC.
- IFC/World Bank Group, 2007. Environmental Health and Safety Guidelines. Industry Sector Guidelines, Infrastructure (Water and Sanitation), Wash. DC.
- AWWA Standard Methods for Measurement and Analysis Environmental Quality.

Specific Environmental Protection and Climate Change Directives and Decisions

- Hue:
    - Resolution No. 06-NQ/TV dated January 20, 1998 by the Standing Committee, Thừa Thiên Huế provincial committee of the party on the conservation and promotion of Huế monument values.
    - Decision No. 2062/QĐ-UBND dated November 29, 2010 by the Thừa Thiên Huế Provincial People's Committee on regulations for the function, tasks, authority and structural organization of the Huế Monuments Conservation Centre.
    - Decision No. 1065/QĐ-UBND dated June 13, 2012 by Thừa Thiên Huế Provincial People's Committee on the Collection and treatment of the common solid waste disposal until 2015, orientation to 2020.
    - Decision No. 1622/QĐ-UBND dated August 26, 2013 by Thừa Thiên Huế Provincial People's Committee on the general planning for overall tourism development in Thừa Thiên Huế in the period 2013 – 2030.
    - Decision No.105/QĐ-TTg dated February 12, 1996 by the Prime Minister on the approval of the Planning for the conservation and promotion of Huế monument values between 1996 - 2010.
    - Decision No.818/QĐ-TTg dated June 07, 2010 by the Prime Minister on the approval of the revised Planning for the conservation and promotion of Huế monument values between 2010-2020.
    - Decision No. 597/QĐ-TTg dated April 16, 2013 by the Prime Minister on the revision the master plan of Huế city until 2030, vision to 2050.
    - Hue City Master Plan for Waste Disposal Sites.
    - The Management Plan of the Complex of Hue Monuments for the Period 2015 – 2020, Vision 2030
    - GoV Decision on GRM
    - Hue Green City Action Plan (2014)
    - Climate Action Plan for Hue City (2014-2020)
- Ha Giang:
    - GoV Decision on GRM
    - Ha Giang Green City Action Plan (2014)
- Vinh Yen:
    - GoV Decision on GRM
    - Vinh Yen Green City Action Plans (2014)
    - Vinh Phuc Climate Action Plan (2015-2030).

C. Responsibility for Environmental Management and Protection

14. The primary agency responsible for national environmental assessment and protection in Viet Nam is the Ministry of Natural Resources and Environment (MONRE). At the provincial level the DONRE represents the MONRE. The DONRE, *inter alia,* is responsible to ensure provincial government agencies, the private sector, and civil society comply with laws and regulations for environmental protection. The M/DONREs review and approve environmental impact assessments, and enforce environmental laws and regulations through inspection and compliance monitoring of government agencies, private sector, and civil society.

D. ADB Safeguard Policy

15. The ADB Safeguard Policy Statement (SPS 2009) clarifies the rationale, scope and content of an environmental assessment and is supported by technical guidelines (*Good Practice Safeguard Sourcebook*). Projects are initially screened to determine the level of assessment that is required according to the following three environmental categories (A, B, or C).

16. Category A is assigned to projects that normally cause significant or major environmental impacts that are irreversible, diverse or unprecedented such as hydroelectric dams (an Environmental Impact Assessment is required). Category B projects have potential adverse impacts that are less adverse than those of category A, are site-specific, largely reversible, and for which mitigation measures can be designed more readily than for category A projects (an Initial Environmental Examination is required). Category C projects are likely to have minimal or no negative environmental impacts. An environmental assessment for Category C projects is not required but environmental implications need to be reviewed. As indicated above the SCDP is Category B for environment.

17. The SPS (2009) requires that a stakeholder consultation strategy be developed that embodies the principles of meaningful engagement, transparency, participation, and inclusiveness to ensure that affected and marginalized groups such as women and the poor were given equal opportunities to participate in the design of the project. To support stakeholder engagement in the SCDP, a grievance redress mechanism (GRM) is also required for the SCDP. The GRM ensures that issues or concerns of potentially affected persons will be heard easily by the authorities.

III. SUBPROJECT DESCRIPTIONS

18. The project will demonstrate economically competitive, environmentally friendly and socially inclusive development for Hue City, Vinh Yen City and Ha Giang City of Viet Nam. The project cities' green and climate resilient development approaches will be replicated and scaled up to achieve secondary city development in Viet Nam.

19. Viet Nam's Socio-Economic Development Strategy, 2011–2020 emphasized the need to sustain the rate of its economic growth while achieving social inclusiveness and environmental protection. This has led to the formulation of the National Program on Urban Development, 2012–2020, that requires efficient, sustainable and equitable urbanization.[20] However, secondary cities face limited financial resources and constrained local investment due to limited basic urban infrastructures and services.[21] Development still needs to rely heavily on public investments because limited size and coverage cannot support economies of scale, and insufficient cost recovery. Their limited capacity to plan, design and prioritize investments also prevents efficient use of public funds and application of innovative ideas.

20. In 2013, Asian Development Bank (ADB) started a policy dialogue with the Vietnamese Government by providing technical assistance support to selected secondary cities for balancing economic growth and environmental sustainability to achieve improved quality of life.[22] The technical assistance selected Vinh Yen City and Hue City whose governments expressed strong commitments. Ha Giang City was added, thereby 3 cities collectively represent different socio-economic characteristics, development constraints, sector priorities and geographical locations.[23] In 2014–2015, a green city action plan (GCAP) for each city was completed and endorsed by respective city governments to mainstream an integrated urban planning and development process by incorporating environmental criteria and climate change adaptation and mitigation to improve urban services.

21. The descriptions of the subproject components of the three SCDP cities presented herein are adapted from the PPTA report[24], and updated where necessary with information and agreements attained during the investment loan missions of January-February, 2017[25]. Original subproject component figures from the PPTA report are supplemented where appropriate.

A. Hue City

22. The original list of subproject components for Hue from Volume 3 of the PPTA report are reproduced in Table 1 and located in Figure 1. As a result of the January 2017 review mission, the Improvement to Citadel Canal/Moat component (SC #8), and the Eco-channel of the An Duong Development Area component (SC #6) were excluded because those components triggered Category A conditions (SPS 2009) due to being located in the core zone of the UNESCO

[20] Prime Minister's Decision 445/2009. *Orientation Master Plan for Viet Nam Urban System Development to 2025 with a vision to 2050*. Viet Nam.

[21] The recent government's financial decentralization policy made many local governments confront large financial deficits due to reduced fiscal budget transfers and limited means of generating the fiscal revenue. Only 13 out of 63 centrally administrated cities and provinces are net contributors to the Viet Nam's central budget.

[22] ADB. 2012. *Technical Assistance Report: Green Cities–A Sustainable Urban Future in Southeast Asia*. Manila

[23] Ha Giang GCAP was funded by TA8671–VIE, ADB. 2012.*Secondary Cities Development Program (Green Cities)*. Manila

[24] PPTA 8671-VIE. Subproject Data Sheets, Volume 3, Secondary Cities Development (Green Cities) Project, ADB.

[25] Post January and February /17 Mission Memoranda of Understanding of between ADB and PPCs of three subproject cities.

Citadel site, and requiring extensive local hydrological study, respectively. Table 2 documents the changes of proposed component specifications between the Feasibility Study in 2017 and the detailed designs in 2018.

Table 1. Original Hue subproject components

SC	Subproject component	SC	Subproject component
1	Dredging and Embankment of Ke Van River	10	Park and Square in the Administrative Area, An Van Duong
2	Drainage and Pavements of Four Wards in Citadel	11	Rehabilitation/Embankment of Dong Ba River
3	Dredging and Embankment of Lakes in Citadel	12	Rehabilitation/Embankment of An Cuu River
4	Water Supply System to Phu Son Solid Waste Management Facility and Villages	13	Rehabilitation/Embankment of Nhu Y River
5	Dredging and Embankment of Lap River, Kim Long Ward	14	Section of Central Road in An Van Duong Development Area including Bridge
6	Eco-Channel of the An Van Duong Development Area[26]	15	Bui Thi Xuan Road
7	Dredging and Embankment of An Hoa River	16	Huyen Tran Cong Chua Road
8	Improvement of the Citadel Canal/Moat[27]	17	Vy Da Bridge and Access Roads
9	Park, Paths, Drainage, and Lighting in An Van Duong Development Area		

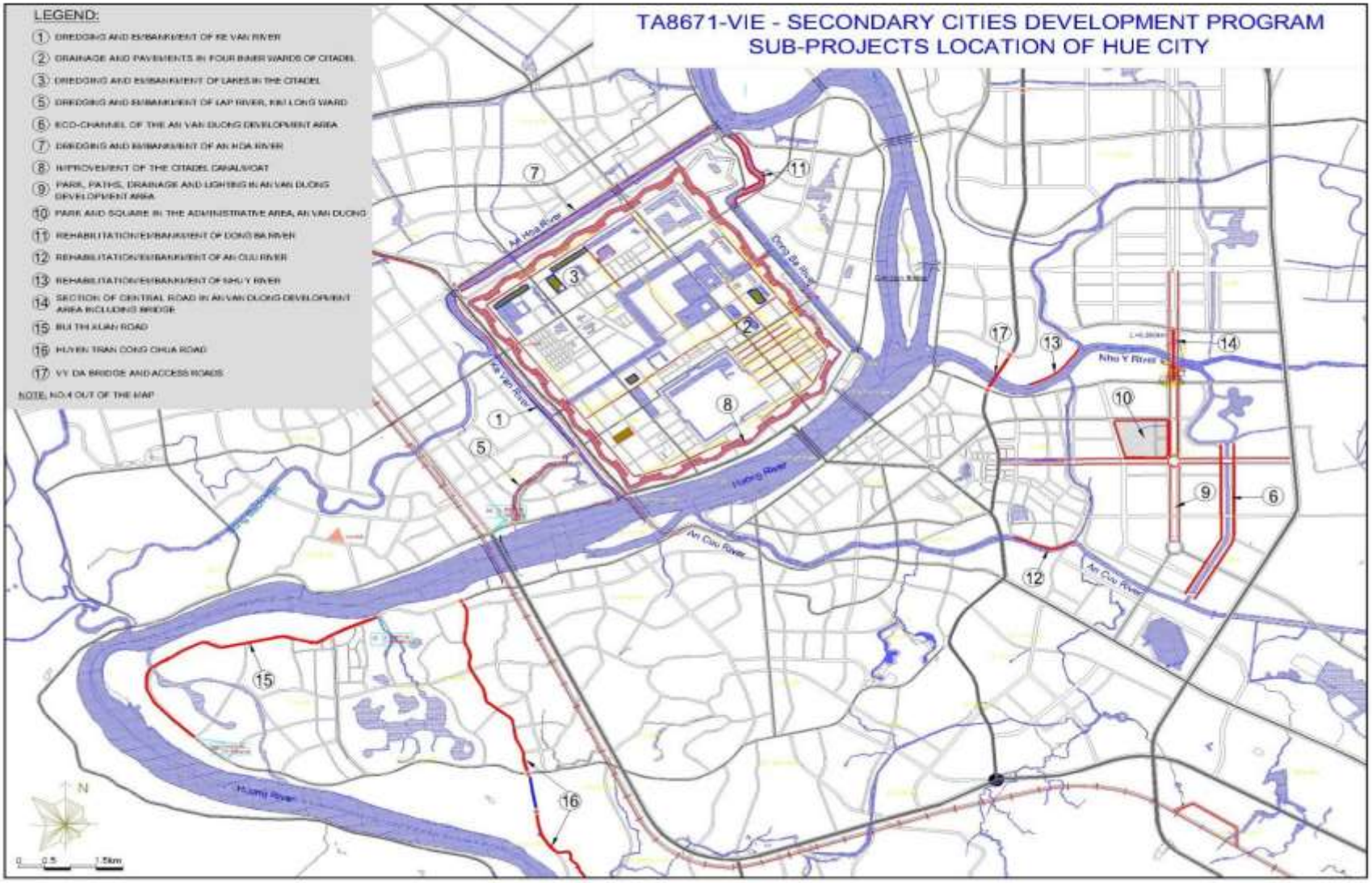
Table 2. Changes made from the detailed design

SC	Subproject component	Changes of specification	Status of updating
1	Dredging and Embankment of Ke Van River	No significant change	No need updating
2	Drainage and Pavements of Four Wards in Citadel	No significant change	No need updating
3	Dredging and Embankment of Lakes in Citadel	No significant change	No need updating
4	Water Supply System to Phu Son Solid Waste Management Facility and Villages	Change of water supply source, pipe alignment and number of water tank	Updating the specification (Refer to Index i)
5	Dredging and Embankment of Lap River, Kim Long Ward	No significant change	No need updating
6	Dredging and Embankment of An Hoa River	No significant change	No need updating
7	Park, Paths, Drainage, and Lighting in An Van Duong Development Area	No significant change	No need updating
8	Park and Square in the Administrative Area, An Van Duong	No significant change	No need updating

[26] Component deleted because it triggered a Category A condition.
[27] Component deleted because it triggered a Category A condition.

9	Rehabilitation/Embankment of Dong Ba River	No significant change	No need updating
10	Rehabilitation/Embankment of An Cuu River	No significant change	No need updating
11	Rehabilitation/Embankment of Nhu Y River	No significant change	No need updating
12	Section of Central Road in An Van Duong Development Area including Bridge	No significant change	No need updating
13	Bui Thi Xuan Road	No significant change	No need updating
14	Huyen Tran Cong Chua Road	No significant change	No need updating
15	Vy Da Bridge and Access Roads	No significant change	No need updating

Figure 1. Location of Hue subproject components



Source: From Volume 3 of PPTA report.

23. The Hue subproject components were also re-organized into components supporting green city and climate resilience urban development, and components supporting transportation and tourist infrastructure access improvements as defined in the post-mission Memorandum of Understanding between the ADB and project owner. Some component names were modified slightly to improve component clarity.

1. Green City and Climate Resilient Urban Development Components

Citadel Protection & Environment Improvements

a. Drainage and Pavement in Four Wards (SC #2)

24. The primary objective of the component is to improve drainage and control flooding of select streets in the Citadel (Figures 2 and 3). Periodic flooding affects over 65,000 residents in the Citadel. Component activities consist of the following:

- Upgrading and rehabilitation of 21.9 km of primary drainage pipeline to improve flood drainage capacity during the rainy season, and increase water removal to protect the Citadel community;
- Proposed installation of road-side bioswales to dampen and clean stormwater runoff;
- Rehabilitation of streets to improve traffic flow in the citadel; and
- Improve landscape and lighting.

25. The proposed “green” upgraded drainage plan in the Citadel is shown in Figure 4. The bioswales along roadways shown in Figure 4 act to dampen and clean stormwater runoff.

Figure 2. Flood prone streets in Citadel

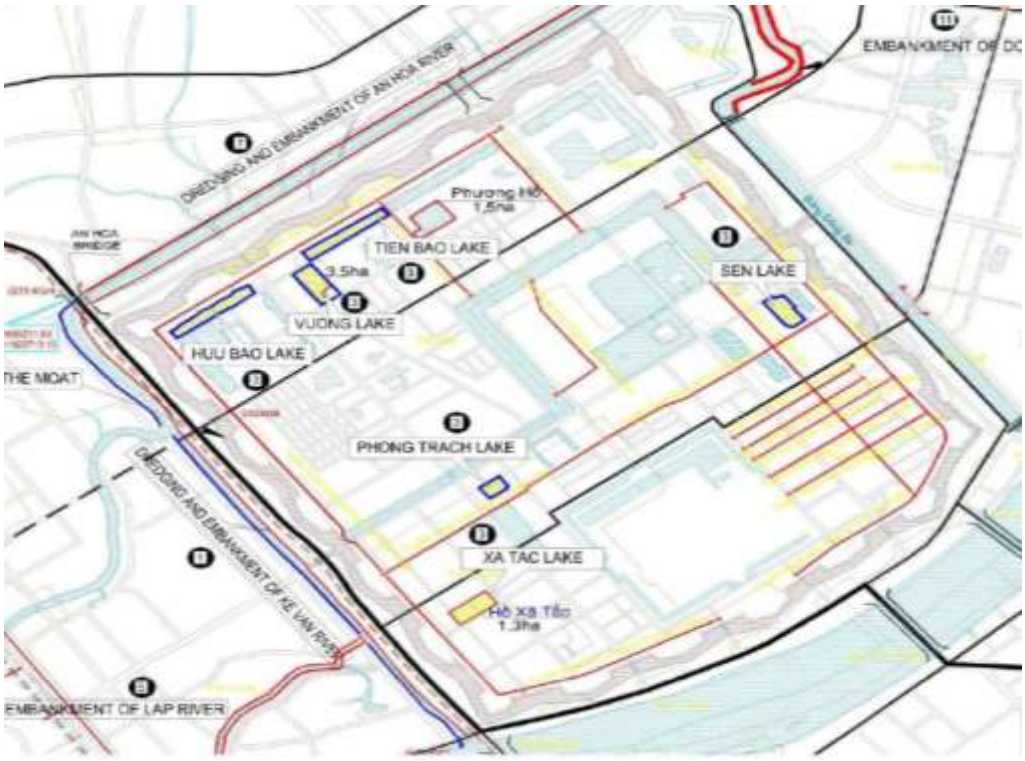
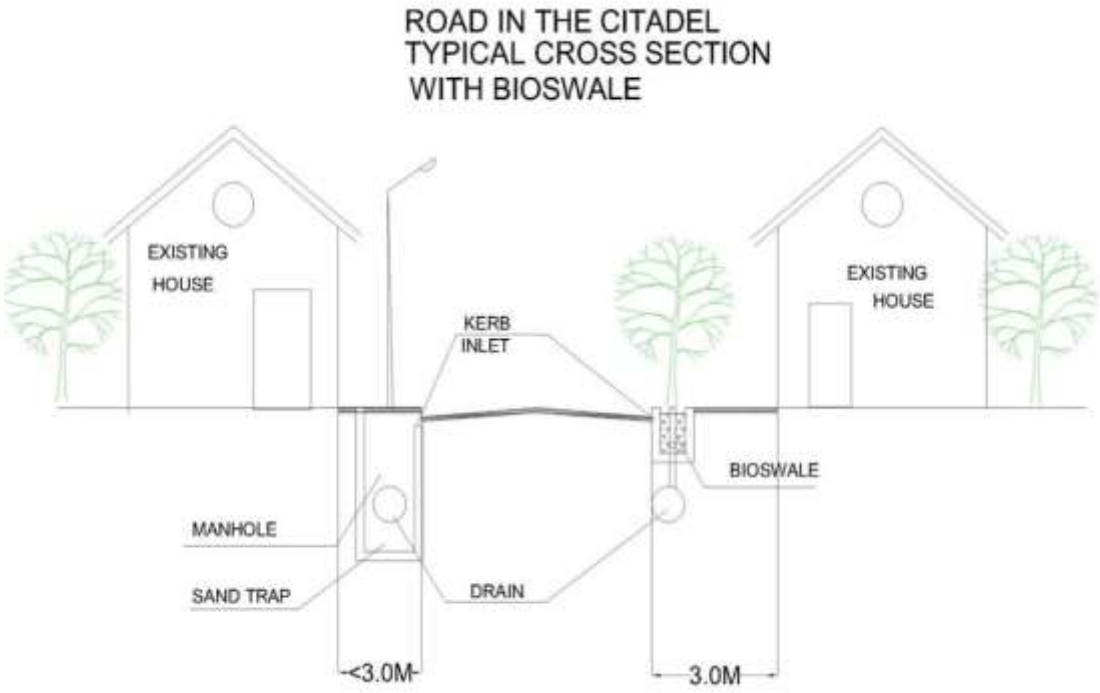


Figure 3. Example street in Citadel requiring side drainage upgrades

Figure 4. Schematic of drainage improvements in Citadel



26. The upgraded Citadel drainage system will be constructed from precast reinforced concrete pipe of diameters ranging from 400, 600, 800, 1000, 1200, 1500mm (Table 2) laid below grade along street-sides. The system will include flow gates capable of isolating the system from the Huong River when Huong River is high during rainy season.

Table 3. Drainage pipe size and length

Pipe diameter (mm)	Estimated total length (m)
400	1,215
600	7,233
800	9,139
1000	2,862
1200	612
1500	814

b. Dredging and Embankments of Citadel Lakes (SC #3)

27. The numerous small lakes (ponds) of the Citadel are polluted (Chapter VI) as a result of indiscriminate discharging of local domestic wastewater and solid waste. The lakes have become shallow with silt and debris which reduces the standing storage of the lakes which exacerbates the poor water quality.

28. The embankments of the ponds have been encroached by human development and activities which have resulted in the shorelines becoming slumped and eroded. This is particularly apparent during the rainy season. Table 3 lists the ponds targeted for dredging which are shown in Figure 5. Lake and river sediment is not contaminated (see below) and will be disposed in sites identified in Hue Waste Disposal Management Plan.

Figure 5. Six lakes of Citadel to be dredged and embankments stabilized.

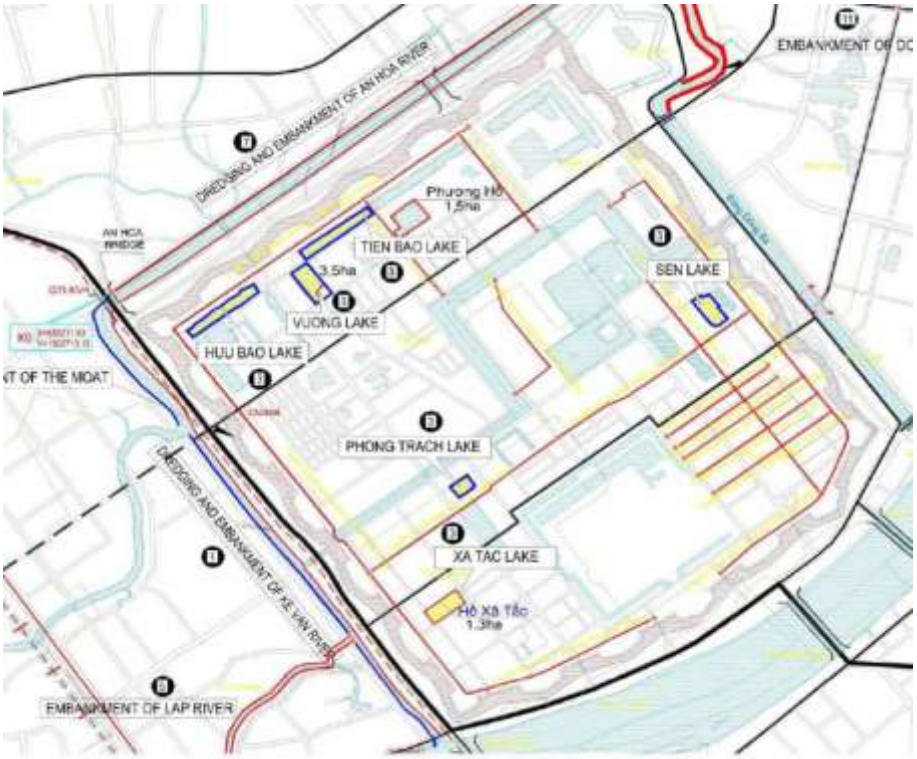


Table 4. Citadel lakes to be dredged and embankments stabilized

Lake/Pond	Area (ha)	Perimeter (m)	Dredging material (m3) *(FS report)*
Tien Bao	1.5	790	12,400
Huu Bao	1.8	805	4,400
Vuong	1.4	520	10,800
Vuong Trac	0.6	315	11,700
Sen	1.3	475	11,000
Xa Tac	1.3	490	11,200

Resilient Water Environment & Infrastructure Development

c. Dredging and Embankment of Ke Van River (SC #1)

29. The Ke Van River (canal) borders the southwest side of the Citadel (Figure 6). This component is meant to improve flow and water quality in the Ke Van River. The river is a man-made bypass located along the southwest side of the Citadel which provides a transportation corridor that derives water from the Huong River. Over time the canal has filled with sediment and sludge from wastewater and solid waste. The west side embankment of the river has been stabilized with a concrete wall embankment. However, the east bank is subject to erosion and needs stabilization. The component is included in the Green Cities Action Plan (GCAP) for Hue, and consists of the following activities:

1. Dredging 2.6 km of the river to improve water quality and flow from Huong river; and
2. Fortifying 2.5 km of the east embankment from Kim Long Bridge to An Loa Bridge.

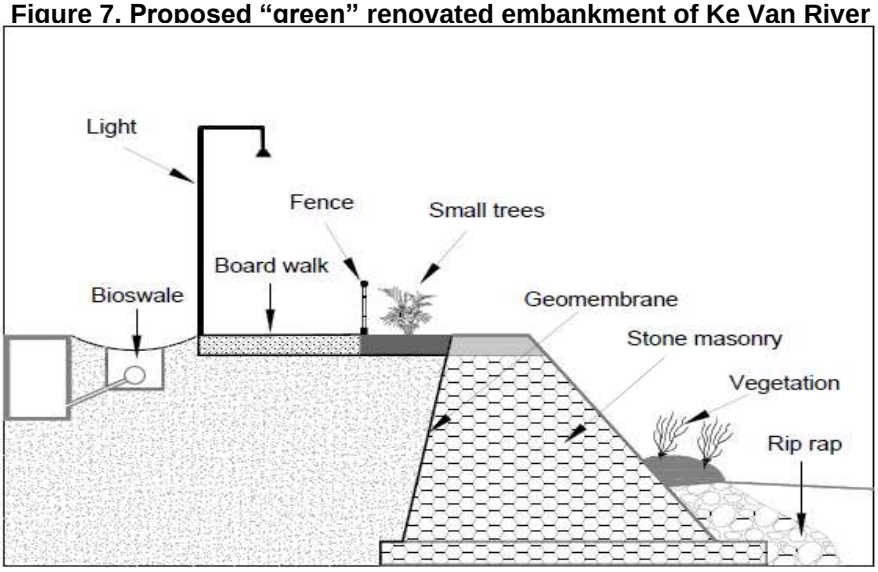
30. All embankment works will use materials consistent with Citadel structures.[28] The dredging of the river will remove an estimated 18,000 m^3 of sediment that will be disposed at a site approved by DoNRE according to the City Master Plan for Disposal Sites. The quality of the sediment has been analysed and determined to be non-polluted (see Chapter IV).

31. Two meters of bottom sediment will be dredged close to the east bank of the canal. The east embankment from the canal bottom will be raised to approximately 4 m, with green and lighted pedestrian attributes planned as indicated in Figure 7.

[28] The Hue Monument Conservation Center (HMCC) will be involved in the review and approval process of Detailed Design to confirm that material selection of component design are in accordance with the Complex of Hue Monuments Management Plan (2015).

Figure 6. Section of Ke Van river to be dredged & embankment (left) stabilization.

Figure 7. Proposed "green" renovated embankment of Ke Van River



d. Dredging and Embankment of An Hoa River

32. The An Hoa river (canal) flows about 2.5 km along the northwest border of the Citadel and is connected to the Ke Van River on the southwest side of the Citadel (Figure 1). The river, with a width varying between 50-70m, is a transportation route and an important part of the Citadel drainage system. Similar to the Ke Van River (canal), the An Hoa River allows runoff and domestic wastewater from the Citadel to be carried out to the Huong River. River water is polluted from domestic wastewater and solid waste. The An Hoa River has widened over the years due to bank erosion and landslip. Similar to the Ke Van River subcomponent, the objective of the An Hoa subcomponent is to improved flow, water quality, and use of the river

for transportation.

33. The subcomponent consists of the following activities:

- Dredging approximately 3 m of bottom sediment along 2.5 km of the river to improve flow from the Huong River, and water quality;
- Structuring the 2.8 km of both embankments of the river to reduce erosion from storm water; and
- Construction of a 3 m landscaped boardwalk along the river with plants and lighting.

34. The dredgate (143.344 m^3) will be disposed in designated sites as per the municipal waste disposal plan introduced above. The new embankment will consist of the following (Figure 8):

- Below water: sloping surface made of stone masonry with foot reinforced with bamboo, and gabion baskets where necessary.
- Above water: stabilized with concrete network on sloping compacted soil surface.
- Maximum grass to be planted in/on network to hold soil and capture runoff.
- Top of embankment: 3 m wide walk way covered with grass and trees with existing trees preserved.

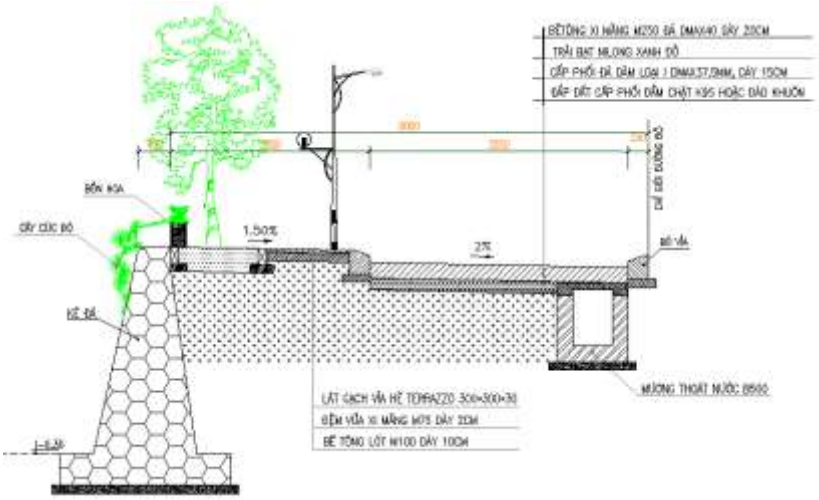
Figure 8. Proposed "green" An Hoa river embankment

e. Dredging and Embankment of Dong Ba River

35. The Dong Ba River borders the northeast side of the Citadel (Figure 1) and connects to the Huong River. Similar to Ke Van and An Hoa Rivers, the Dong Ba River acts as a canal to convey wastewater and stormwater from the Citadel out to the Huong River. The northern end of the river near the confluence with Huong River will be dredged and the existing embankment rehabilitated (Figure 9). The existing embankment includes a small road that will also be upgraded. All buffer zones of Citadel will be maintained, and each activity will be buffered away from all external areas.The subcomponent has three primary activities:

- Construction of 3 m boardwalk along the embankments;
- Upgrade of 1.7 km of embankment road including new drainage system; and
- Dredge river along rehabilitated embankments out to Huong River.

Figure 9. Proposed rehabilitated "green" Dong Ba river embankment & road



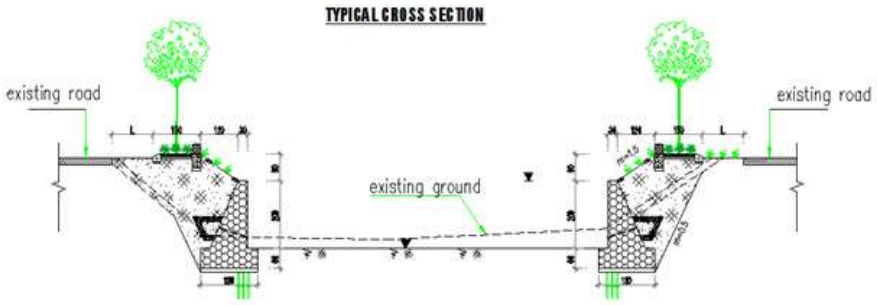
f. Dredging and Embankment of Lap River

36. The Lap River connects the Ke Van River to the Huong River at the southwest corner of the Citadel (Figure 1). Currently the Lap River is blocked at the confluence with the Huong River, and at the eastern end, near Ke Van River the Lap River is reduced to a narrow (0.5-1.0 m) channel. Dredging is planned to remove the blockage, and to restore flow from Ke Van River through Lap River to the Huong River. Also proposed are new walkways along rehabilitated embankments on both sides of the river (Figures 10 and 11). Currently there is a narrow road (3.5m) on the south side of the Lap River. There are extensive mature trees on both sides of the river which will be preserved as much as possible. The subcomponent consists of the following activities:

- Dredging 3 m of entire 1.3 km river and remove the blockage to improve flow to/from the Huong river and water quality;
- Structuring 1.0 km of embankment of both sides of the river to reduce erosion from storm water;
- Creating a 1.0 km, 3 m landscaped embankment of stone and vegetation with plants and lighting; and
- Construction of a double box culvert 2 x (2 m^2) for the narrow river section which is crossed by a small access road.

Figure 10. Section of Lap river

Figure 11. Proposed cross-section of "green" rehabilitated embankment of Lap River



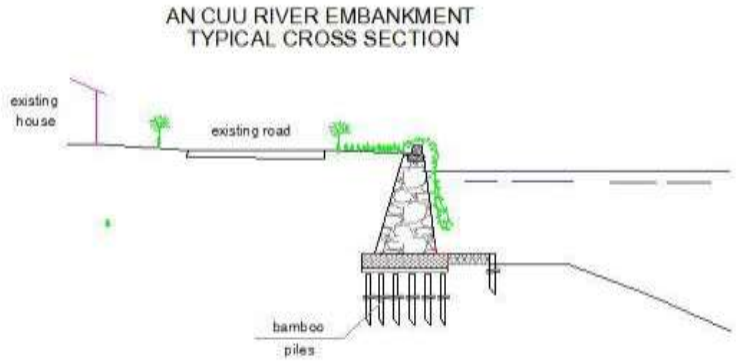
g. Rehabilitation and Embankment of An Cuu River

37. The An Cuu River is a tributary of Huong River and a major city drainage channel that flows to Hue city centre from the south. A 0.5 km section of the northern embankment of the river near the near the An Cuu Bridge will be rehabilitated (Figure 1). Similar to other rivers and canals local residents have discharged wastewater and solid waste into this section of the river . The embankment improvement works will complement earlier rehabilitation projects financed by the government, which supports the stormwater component of the Hue Master Plan for rehabilitation of local rivers.

38. Embankment rehabilitation will include repairs to 115 m of existing embankment wall with stone. A 0.5 m section of new embankment will be constructed on the opposing side of the river which would be landscaped between existing road and river.

Figure 12. Section of An Cuu river embankment

Figure 13. Proposed "green" profile of new embankment along An Cuu River

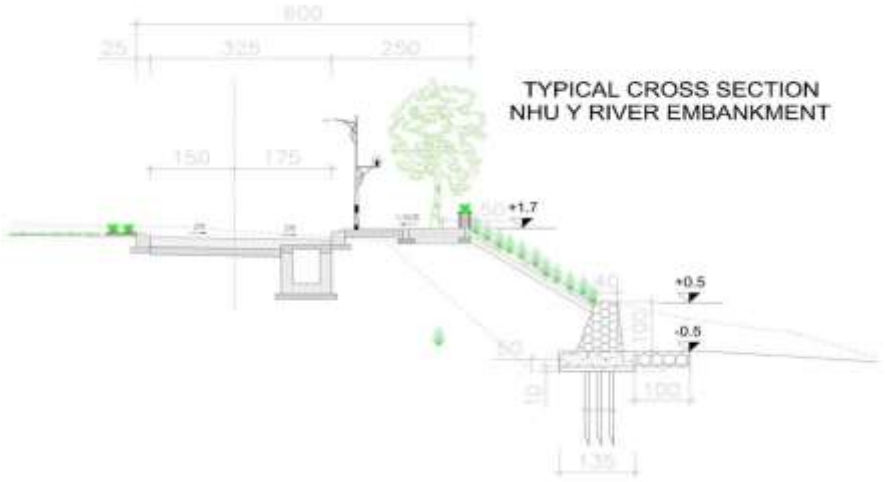


h. Rehabilitation and Embankment of Nhu Y River

39. The Nhu Y River is a tributary of the Huong River and also a drainage canal for Hue City which flows to Hue City parallel to and north of the An Cuu River. A 0.35 km section of embankment on the north side of the river will be developed just upstream of Vi Da Bridge and south of the new An Duong Development Area (Figures 1 and 14). The section of embankment to be rehabilitated lies adjacent to sections of existing stone embankments as exemplified in background of Figure 14.

Figure 14. Embankment of Nhu Y river to be rehabilitated.

Figure 15. Profile of proposed "green" rehabilitated Nhu Y river embankment



40. Similar to An Cuu River and the canals surrounding the Citadel, local residents discharge wastewater and solid waste into the river. The objective of the embankment work is to improve flow and water quality in the river as per the stormwater component of the Hue City Master Plan 2030 and Vision's 2050 for the rehabilitation of the major rivers of the urban area. The component is the approved plan for the adjacent An Van Duong Development Area.

i. Water Supply to Pho Son Villages and Municipal Solid Waste Treatment Facility

41. As per the original IEE, the subproject component consisted of construction of a 30.8 km water supply from an existing Hue City water treatment plant in Phu Bai Industrial Park, Phu Bai ward, Huong Thuy District to 530 household connections in four villages of Phu Son commune located southwest of Hue. However, according to the approved detailed design, the water supply source is

changed by taking water from Ben Van water plant in Xuan Loc commune, Huong Thuy District. The length of pipeline is slightly reduced from 30.8 Km to 29.4 Km, and instead of going to Phu Son commune from Phu Bai ward in northeast, the new pipeline will come from Xuan Loc commune located south of Phu Son commune. The water supply will directly benefit the four villages of Phu Son commune from improved health and sanitation, and overall improved quality of life in the four villages. The component supplies water to a nearby future solid waste treatment plant in Phu Son commune as well.

42. The water supply pipeline will start from the Ben Van water plant and will extend 29.4 km to the four village areas as well as the solid waste treatment plant (refer to Figure 16). Water will flow by gravity to the beneficiaries of the four villages through pipeline of gauge ranging DN75-160. With a booster pumping station (reducing a station from original IEE) with a capacity of 39 m^3/day (reducing from 1000 m^3/day), water will be pumped into a 50m^3 storage reservoir only for the plant (the plant is located in a higher altitude area) and into three 10m^3 storage reservoirs for pressure regulation in case that the distribution line got broken.

Figure 16. The proposed water supply to Phu Son Commune by detailed design

Landscaping and Public Green Space

43. The two subproject components identified below for explicit landscaping and green space development support the government's initiative to develop the An Van Duong suburban area south of Hue city.

j. Park, Path, Drainage, and Lighting in An Van Duong

44. This subproject component is focused on linear "green" development along a section of the main central road axis in the new suburban area of An Van Duong (Figures 1, 17 & 18). Approximately 4.4 km of the corridor of one of the two major road axes will be developed for parkland to provide a recreation area for local residents. The new suburban area of An Van Duong is one of the new green districts of Hue city, and is mentioned in the GCAP of the city.

45. The two axis roads have already been built with only the carriageways in place. The carriage ways will be integrated with sidewalks, traffic signs, landscaping, drainage, and lighting, which combined will form a linear park area ith proposed additional 75 m of lateral park area (Figure 19).

Figure 17. Axis roads in An Van Duong for linear parkland development

Figure 18. Section of axis road in An Van Duong for linear "green" development

Figure 19. Proposed attributes of linear development of axis roads

k. Park and Square in Administrative Area

46. Integral to the development of the An Van Duong suburban area is a 17.2 ha park and administrative area located at the northwest corner of the two axis roads of An Van Duong area (Figures 20 and 21). The square is slated to become the new central administrative core for Hue where all CPC and PPC buildings would be relocated.

47. While the detailed design of the park and administration area has not been finalized, the indicative plan for the square is a core of administration buildings with a central fountain that is surrounded by parkland, and an extension of the adjacent linear parkland along the axis roads. It is anticipated that included landscaping would take up from one-quarter to one-third of the total

site area. The conceptual design shows official buildings, small service roads, and uniform landscaping of rows of trees, bushes, and sidewalks throughout. Bench seating along sidewalks is also anticipated.

Figure 20. Site of Administration area (from Figure 17)

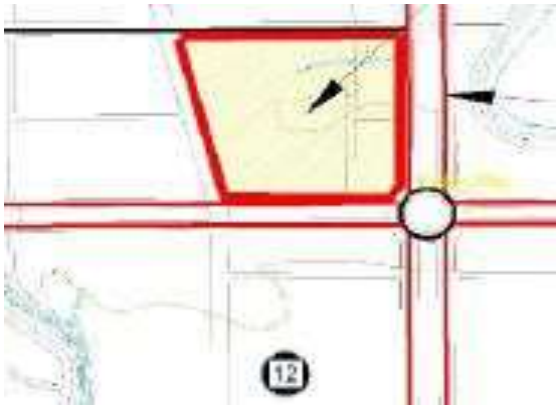


Figure 21. Site of park and administration area in An Van Duong

2. Integrated Urban Road Network and Improved Tourist Access

Tourist Access Improvement

a. Bui Thi Xuan Road; Huyen Tran Cong Chua Road

48. Bui Thi Xuan road and Huyen Tran Cong Chua road which are used by tourists to visit the ancient Tombs of Kings (integral part of the Complex of Hue Monuments) located southwest of Hue city will be upgraded (Figures 1, 22, and 23). The planned new alignments for both roads were reduced in width subsequent to the PPTA in order to reduce required resettlement.

49. Approximately 3 km of Bui Thi Xuan road will be widened from between 13.5 – 16.5 m. An existing bridge will be upgraded to 31m X 13m (Figure 22). This road provides regional

connections to the historic monuments and other tourist attractions—green houses and gardens. The road provides improved access to Nguyen Dynasty monuments as well as some traditional garden houses which are protected by the PPC. The upgraded road will connect Huyen Tran Cong Chua Street in the north to Luong Quan Street.

50. Similarly, 4.2 km of Huyen Tran Cong road will be upgraded and widened to 7.5-16 m. The upgraded section will connect Bui Thi Xuan road to Vong Canh Hill. Huyen Tran Cong road traverses green houses and gardens while providing access to two monuments including Lang Tu Duc Temple.

51. The upgrades to both roads will include new aggregate grading above existing low lying areas, new asphalt, and new guard rails where needed. The shoulders will be landscaped and will included drainage culverts where needed (Figure 24). Landscaping may include lighting systems.

Figure 22. Bui Thi Xuan road (left), and Huyen Thi Cong road (from Figure 1)

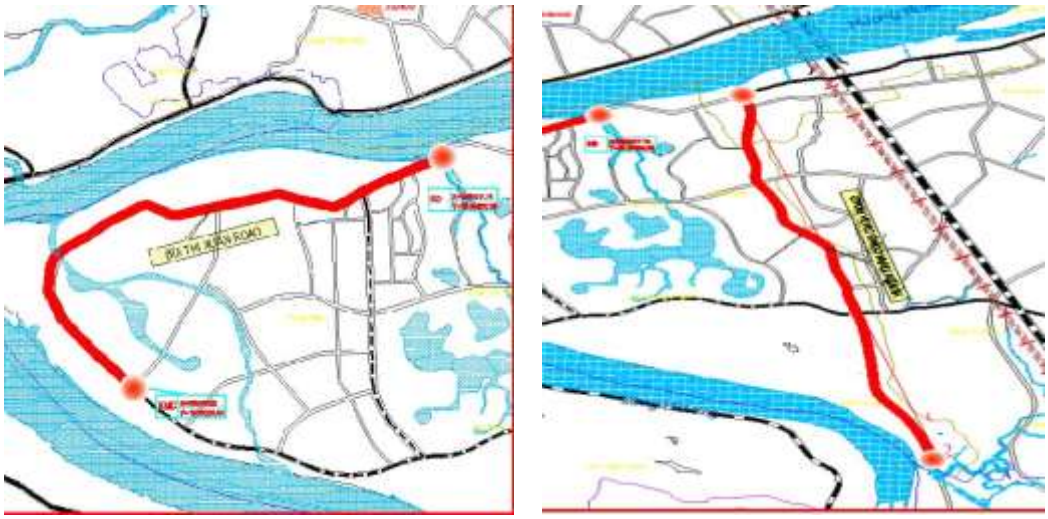
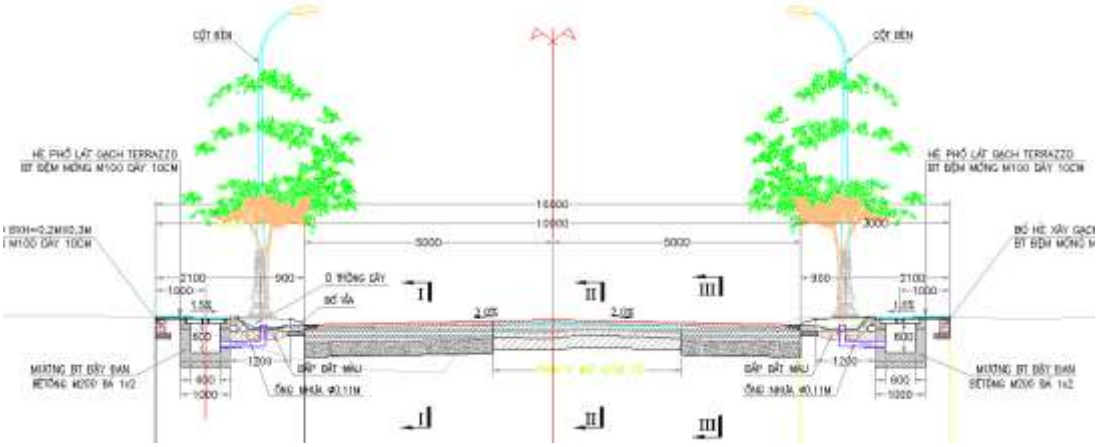


Figure 23. Sections of Bui Thi Xuan & Huyen Tran Cong roads

Figure 24. Profile of upgraded alignments of Bui Thi Xuan & Huyen Tran Cong roads



Road Connectivity Improvement

b. Vy Da Bridge Expansion and Access Road

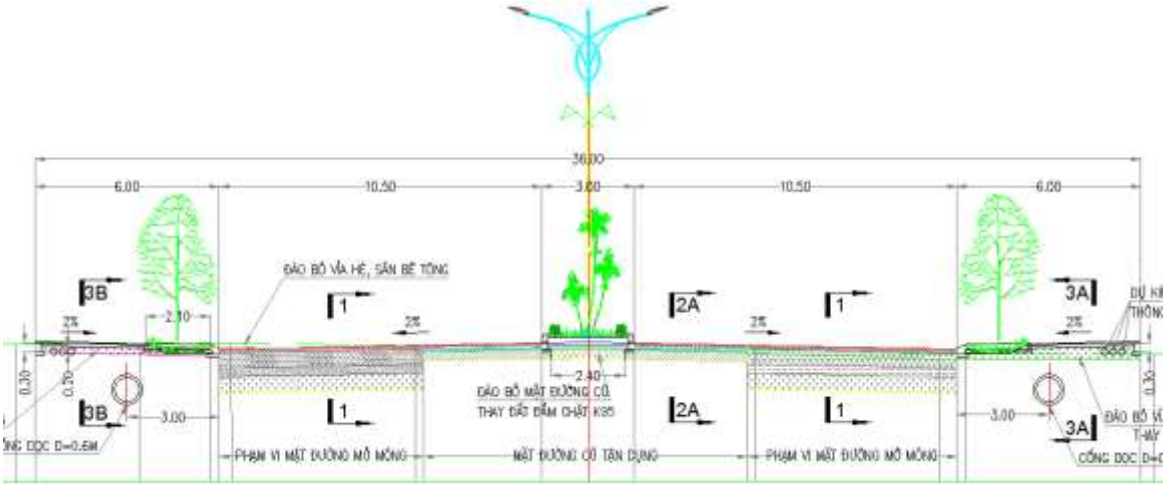
52. To relieve heavy daily traffic loads the Vy Da bridge that crosses the Nhu Y River will be upgraded. The existing Vy Da bridge is 14.0 m wide including 8m for driveway and 2x2.5m for pedestrian. The bridge currently acts as a bottleneck in the important eastern arterial route to and from the bridge (Figures 1 and 25).

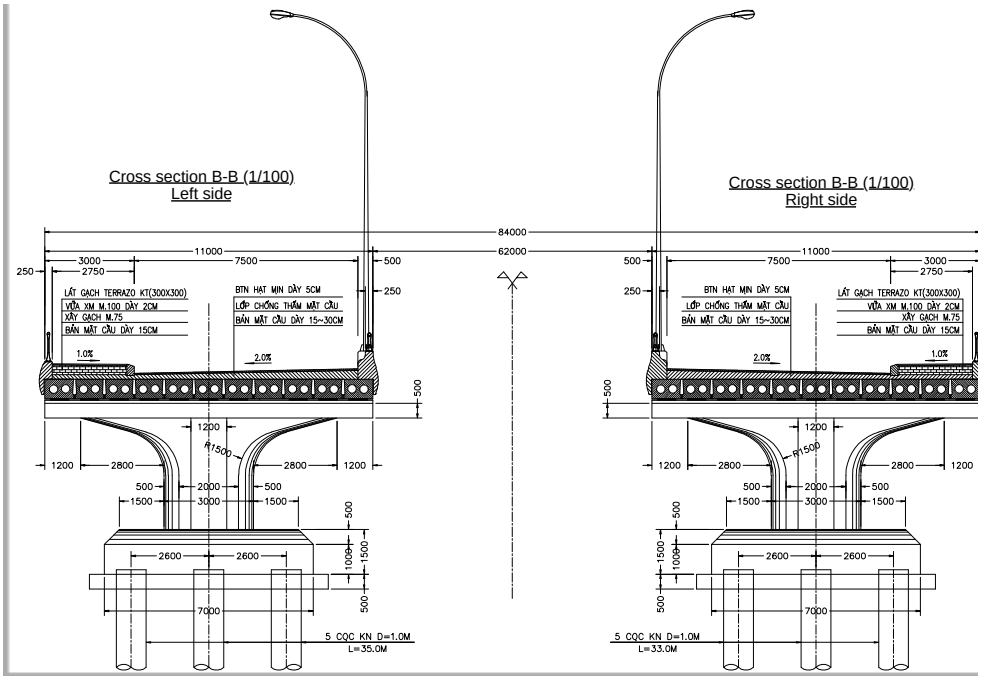
53. The bridge is located about 200 m downstream of the section of embankment that will be upgraded. Approximately 175 m of Vy Da bridge will be widened with an extra lane from 14 m to 30 m. The extra lane will be added to upstream side of bridge (Figure 25). In addition to the bridge, 275 m of the southern Pham Van Dong, and northern Nguyen Sinh Cung street approach roads will widened to meet the widened bridge.

54. The current plan is to landscape the widened bridge and approach roads. The approach roads would include sidewalks and lighting (Figure 26), a treed median, and lateral drainage. The upgraded bridge and approach roads would include new pavement and guard rails.

Figure 25. Vy Da bridge an Pham Van Dong approach road

Figure 26. Schematic of proposed widened approach roads to Vy Da bridge





c. Bridge Connecting Area A and B of An Van Duong Development

55. Two 95 m parallel bridge sections over the Nhu Y river with 369 m of approach roads will be constructed to join two growth areas of the An Van Duong Development (Figures 27 and 28). The approach roads to the bridge will be extensions of existing roads on both sides of the river which include the existing roundabout on the south side in An Van Duong. No bridge exists in the immerdiate area.

56. The subproject subcomponent is part of larger upgrading and new road construction in the southern part of the Hue city at the intersection of the north-south, and east-west axes of economic development, and tourism development, respectively in Hue city. The development of the An van Duong area is part of the overall plan to develop suburban neighbourhoods of the city.

57. The planned approach road sections will have two asphalt carriageways of approximately 20 m each separated by a landscaped median of 60m (Figure 29). The parallel concrete bridges will each provide 11m carriageways and 3m sidewalks. The bridge complex will have drainage and lighting.

Figure 27. New bridge over Nhu Y river east of Hue city (from Figure 1)

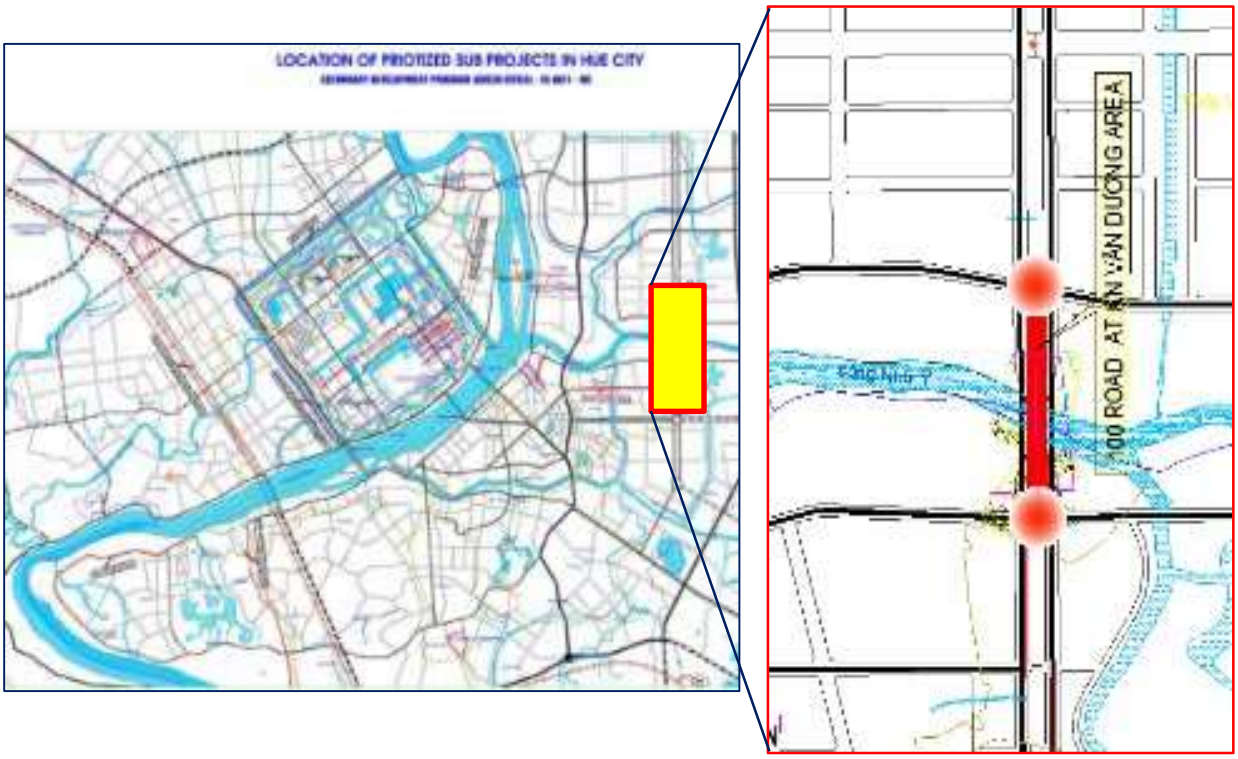


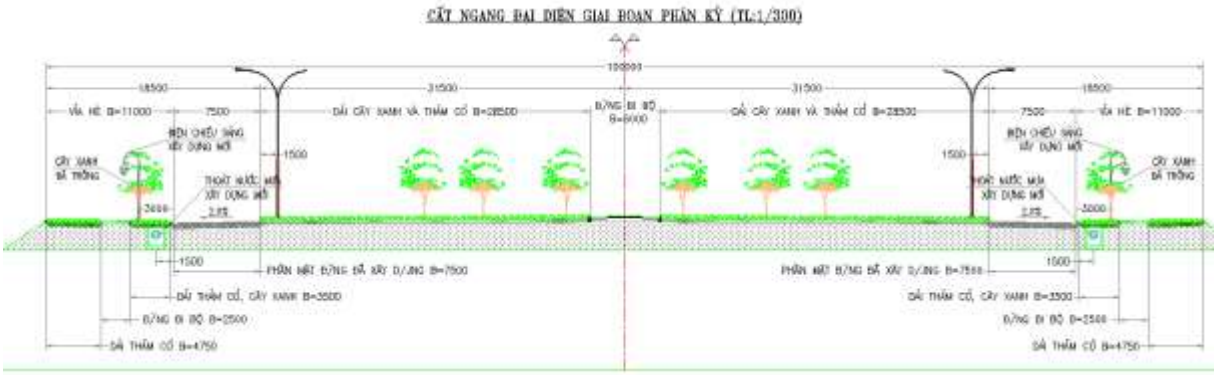
Figure 28. Sections of future road and bridge crossing

a) at beginning point of southern approach road to bridge, at existing roundabout

b) river road parallel to Nhu Y river which will be crossed by approach road from a)

c) point where new bridge will cross Nhu Y river

Figure 29. Cross section of planned landscaped approach roads to bridge



B. Ha Giang City

58. The original list of subproject components for Ha Giang city from Volume 3 of the PPTA report[29] are reproduced in Table 5 and shown in Figure 30. As a result of the February, 2017 review mission the Improvement of Existing Landfill (SC #7) was deleted from subproject because the component triggered a Category A condition (SPS 2009) due to the level of effort that was required to assess the environmental performance and potential remediation of the existing landfill. A component for improving street lighting has been supplemented into the Ha Giang subproject in March 2017 by the decision No.450 dated 23 March 2017 of Ha Giang Province People Committee. Table 6 reproduces the the changes of proposed component specifications between the Feasibility Study in 2017 and the detailed designs in 2018.

Table 5. Ha Giang subproject components from PPTA report

SC	Subproject component
1	Drainage for Tran Phu and Nguyen Trai Wards
2	Drainage for Minh Khai Ward
3	Drainage of T1, T2, T3, and T4 in Quang Trung Ward
4	Western Embankment of Lo River
5	Embankment and Roads on each side of Mien River
6	Southern Embankment of Me Stream
7	Improvement of Existing Landfill[30]
8	Upgrading of National Road No.2
9	Southern Ring Road Improvement
10	Bridge from National Road No 2 to Southern Ring Road

[29] Footnote 8.
[30] Component deleted because it triggered a Category A condition.

11	Rehabilitation of Street Lighting System of Ha Giang City[31]

Table 6. Changes made from the detailed design

SC	Subproject component	Changes of specification	Status of updating
1	Drainage for Tran Phu and Nguyen Trai Wards	No significant change	No need updating
2	Drainage for Minh Khai Ward	No significant change	No need updating
3	Drainage of T1, T2, T3, and T4 in Quang Trung Ward	No significant change	No need updating
4	Western Embankment of Lo River	No significant change	No need updating
5	Embankment and Roads on each side of Mien River	No significant change	No need updating
6	Southern Embankment of Me Stream	No significant change	No need updating
7	Improvement of Existing Landfill[32]	No significant change	No need updating
8	Upgrading of National Road No.2	No significant change	No need updating
9	Southern Ring Road Improvement	No significant change	No need updating
10	Bridge from National Road No 2 to Southern Ring Road	No significant change	No need updating
11	Rehabilitation of Street Lighting System of Ha Giang City[33]	Added to the subproject after the clearance of original IEE	Updating the specification (refer to Para 63)

59. Similar to the Hue city subproject, the components of Ha Giang subproject have been re-organized into climate resilient urban development and transportation network development component activities. Common component types are further grouped for clarify.

1. Climate Resilient Urban Development

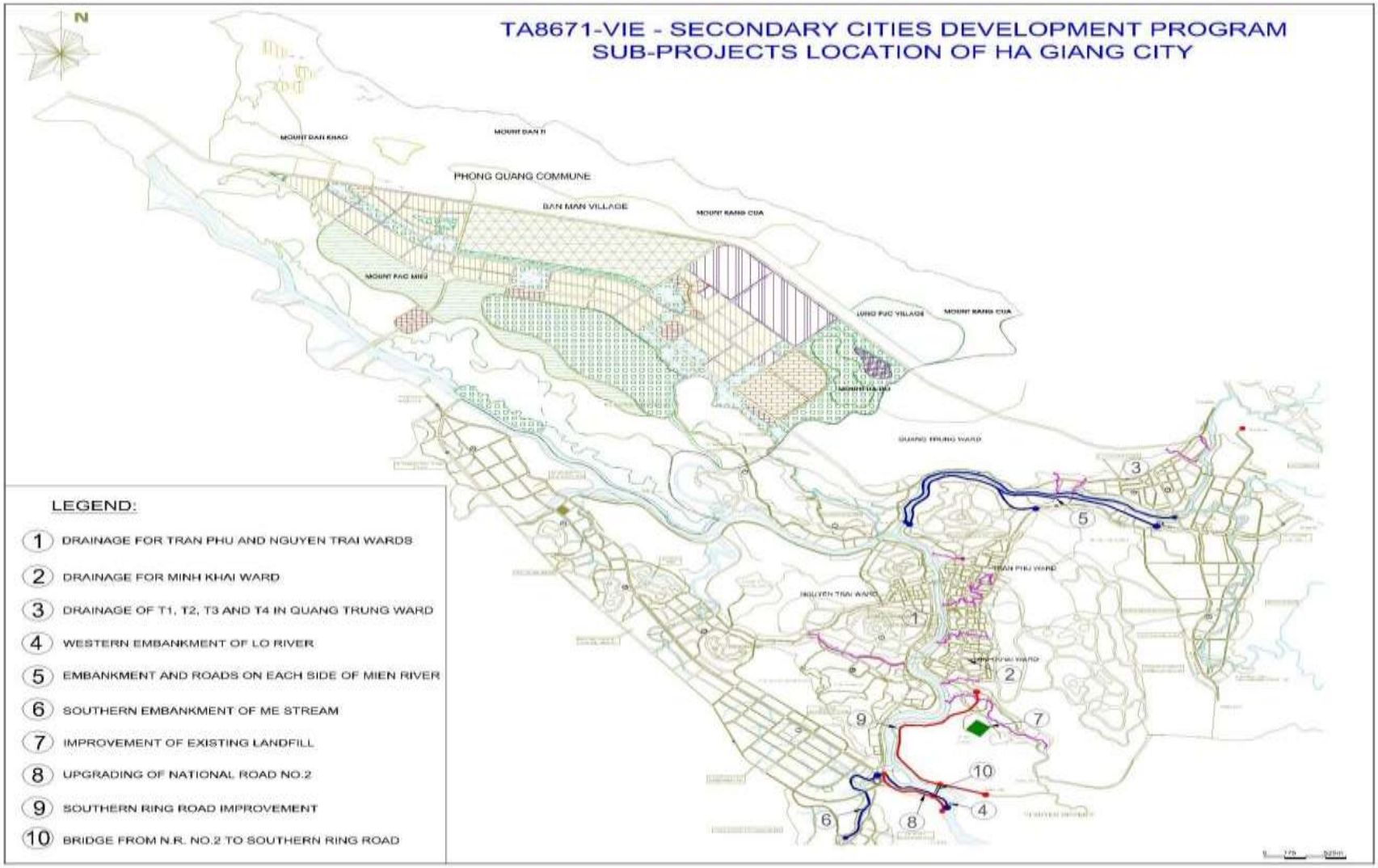
Drainage Channel Improvement & Environmental Rehabilitation

a. Rehabilitation of Drains in Four Wards of Minh Khai, Tran Phu, Quang Trung, and Nguyen Trai

60. The short mountain streams that flow through Wards of Minh Khai, Tran Phu, and Nguyen Trai to the Lo River, and through Quang Trung Ward to the Mien River in Ha Giang have become combined stormwater - domestic wastewater sewers. (Figures 30 and 31).

[31] The steet lighting component is added to Ha Giang subproject by the decision No.450 dated 23 March 2017 of Ha Giang Province People Committee.
[32] Component deleted because it triggered a Category A condition.
[33] The steet lighting component is added to Ha Giang subproject by the decision No.450 dated 23 March 2017 of Ha Giang Province People Committee

Figure 30. Location of the Ha Giang subproject components



Source: Volume 3 of PPTA report.

Figure 31. Example stream drains to Lo and Mien Rivers four Ha Giang Wards

61. Residents dispose solid and liquid waste in the streams, and use the stream banks to raise poultry and other small livestock. Consequently the streams have become polluted which becomes quite noticeable during the dry season. Natural stream flow has become impeded with many sections of the streams narrowed and partially blocked due to garbage and bank slumping. As a result local flooding occurs regularly.

62. The subproject component will clean and rehabilitate the main storm drain-streams in the four Wards and install where needed small box culverts to direct flow (road crossings). In Minh Khai Ward 2.9 km of stream-drains will be rehabilitated, 1.5 km rehabilitated in Tran Phu Ward, 1.2 km of drains in Quang Trung Ward, and in Nguyen Trai Ward 1.4 km of drains will be rehabilitated. The objective is to restore as much as possible the existing naturally vegetated stream-drains to recover as much as possible the naturally absorptive and waste treating capacity of the stream courses. The box culverts will range from 1.5mX1.5m to 2.5mX5m for mid-stream locations and (2.5x6.5)x2.5m culverts at discharge points to the Lo River and Mien River.

Parallel wastewater collection & treatment

63. A new wastewater collection network and wastewater treatment plant will be built by DANIDA for domestic water produced by the households the Wards of Minh Khai, Tran Phu, and Nguyen Trai. Thus, alongside the rehabilitation of the streams, discharge of domestic wastewater will stop which will greatly augment the overall restoration of the streams.

Street light improvement & energy saving

64. Rehabilitation and removal of 1,900 old high-pressure sodium lights and replace them with LED street lights. LED street lights are more energy efficient, have long life spans (over 20 years), and produce better color and light quality than typical High Pressure Sodium (HPS) street lights.

River Embankment Protection and Ecological Upgrading

b. Western Embankment of Lo River

65. Approximately 0.96 km of the embankment of the Lo River alongside National Road #2 in southern Ha Giang city will be upgraded and landscaped (Figures 30, 32, & 33). The embankment upgrades will be integrated with upgrades to adjacent National Road #2, and a new bridge to be constructed across the Lo River that will connect National Road #2 to a new Ring Road to be constructed on the east embankment of the Lo River (see these three components below).

66. The embankment at this section of Lo River is 8 - 10m high. The average rise in water level ranges from 5 - 8 m between the dry season and the flood season, which is also affected from the periodic discharge s from upriver dams in the People's Republic of China.

Figure 32. Sections of Lo river (and Me stream) to be rehabilitated

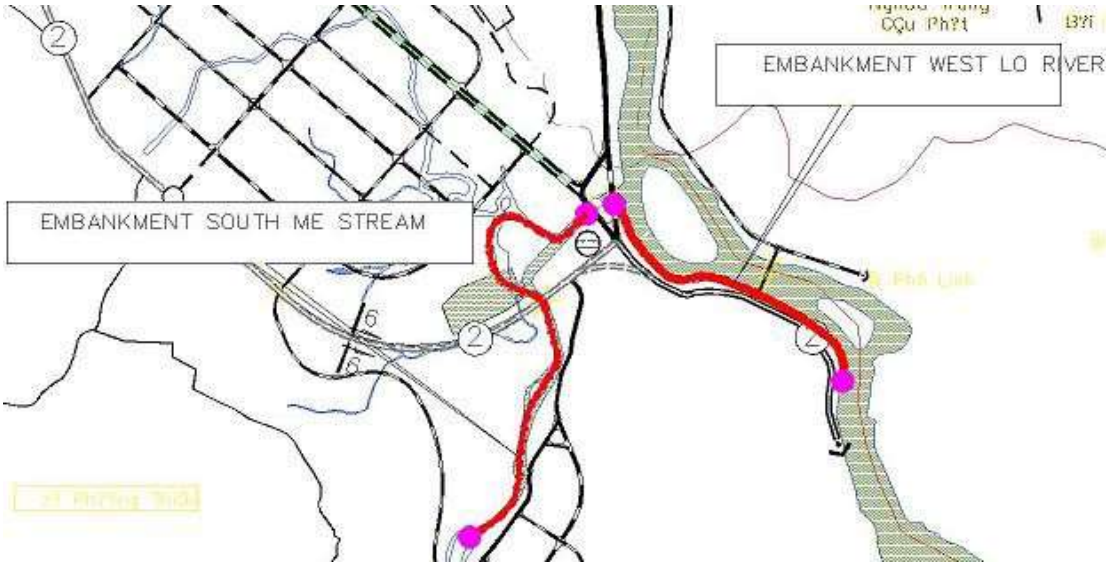
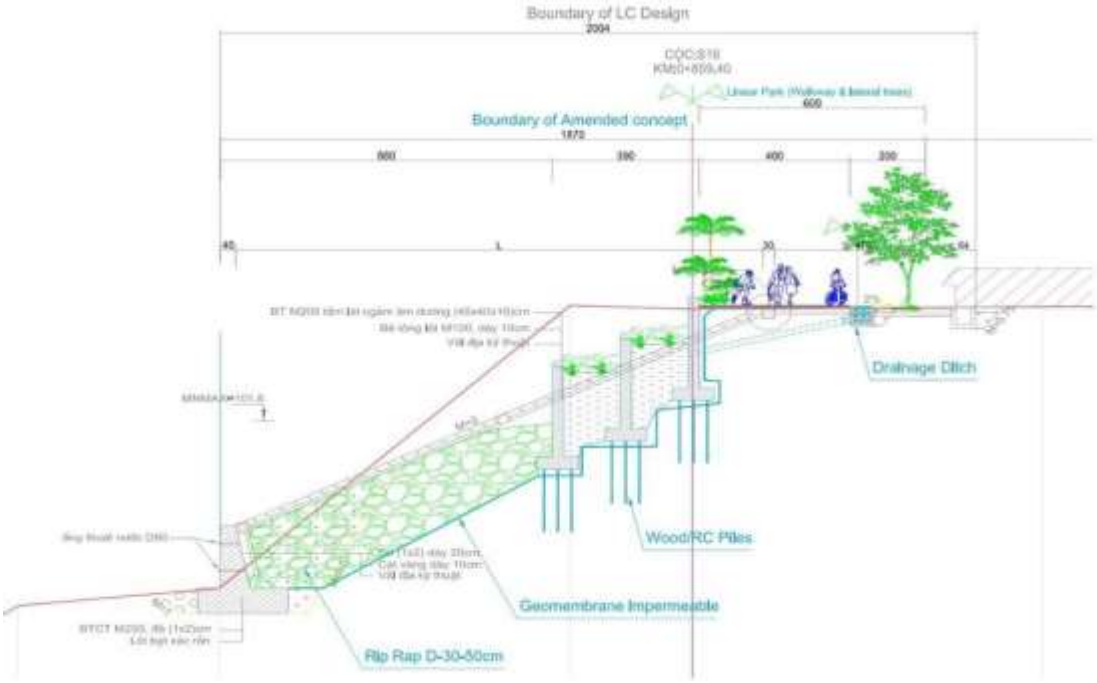


Figure 33. Embankment (foreground) of Lo River to be rehabilitated (& new bridge site)

67. The proposed design of the rehabilitated and landscaped embankment is shown in Figure 34. A 6 meter-wide linear park is included on top of the embankment. The park includes a path for non-motorized vehicles, trees, plants, lighting, natural drainage (with gravel filtration) and seating. Stairs are proposed every 50 m for people to fetch water or do washing.

Figure 34. Cross section of proposed rehabilitated west embankment of Lo River



68. The western embankment of Lo River requires rehabilitation to:

- Prevent erosion of banks;
- Stabilize river and embankments to ensure flow capacity can adapt to climate change;
- Provide disincentive for residents for dumping solid waste in the river; and
- Contribute to reducing environment pollution by creating a green landscape in the City.

c. Embankments of Mien River

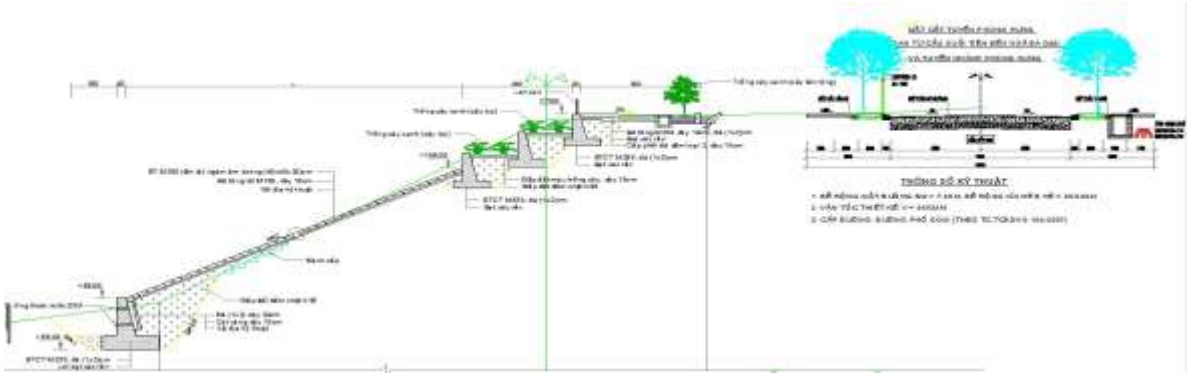
69. Three kilometers of the south (2100m) and north (900m) embankments of the Mien River will be rehabilitated and fortified including landscaping (Figures 30, 35, and 36). The embankment works will be integrated with the upgrading of Phung Hung road (see below) which lies alongside to the southern section of embankment (Figure 35). This river has several hydropower plants upstream and flow of river is controlled.

Figure 35. Embankments of Mien River to be rehabilitated (& upgraded Phung Hung road)

Figure 36. Section of north embankment (background) of Mien river to be rehabilitated

70. The proposed fortified embankments have a 1.5 to 2 slope and are landscaped (Figure 37). They consist of reinforced conventional concrete plates for the underwater bottom part and two vegetated terraces on the top part. A 6 meter-wide linear park is included on top of the embankment, and stairs are proposed every 50 m for people to fetch water or do washing. The linear park would be integrated between the embankment and Phung Hung road. The park linear path would support non-motorized vehicle, trees, plants, lighting, natural drainage (with gravel filtration) and seating.

Figure 37. Profile of rehabilitated embankments of Mien river (& Phung Hung Rd)



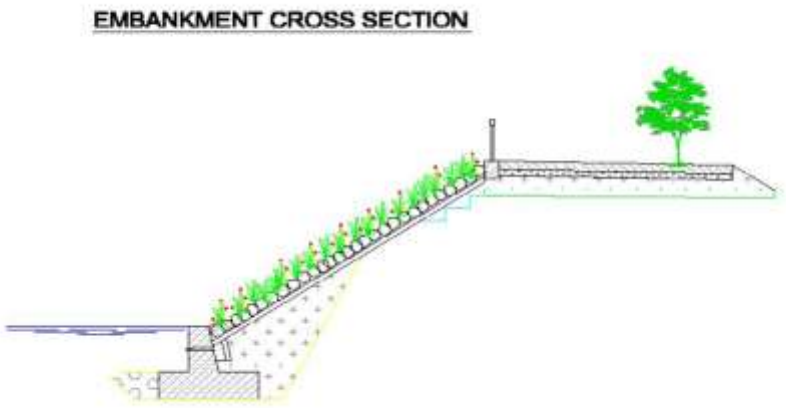
d. Southern Embankment of Me Stream

71. Rehabilitation 1.6 km of the eastern embankment of the Me stream will occur between the old Me bridge and the confluence with the Lo River (Figures 32 and 38). This tributary of the Lo River is small with no significant indications of erosion with vegetation and trees established on both sides of the river. Focused effort will be expended to avoid or minimize cutting of the trees.The need for a raised embankment is to protect a local residences from flooding on exceptional events.

72. The proposed embankment will include a linear park, and pedestrian walkway on the top of the embankment that will be landscaped (Figure 39). The embankment is different from conventional concrete plate embankments with a gentler slope allowing more implanted vegetation and pedestrian walkways. The pedestrian path includes plants and trees. This landscaped pedestrian walkway and linear park can integrate additional trees, lighting and seating (with occasional shelters) along a corridor width of 5-10m.

Figure 38. Embankments of Me stream to be rehabilitated

Figure 39. Proposed profile of rehabilitated embankment of Me stream



2. Integrated Urban Road Network Development

a. Upgrade of Phung Hung Road on Southern Embankment of Mien River

73. The Phung Hung road which is located opposite the section of the northern embankment of the Mien River that will be rehabilitated will be upgraded (Figures 35 and 37). Approximately 2.05 km of the existing single dirt track will be upgraded and extended to include two carriageways of 3.5m and 3m sidewalks, lighting, and bioswales for drainage. A sidewalk and bicycle path will be integrated within a linear park between the river and the road. The expected road surface is DBST or asphalt.

b. Upgrading National Road #2

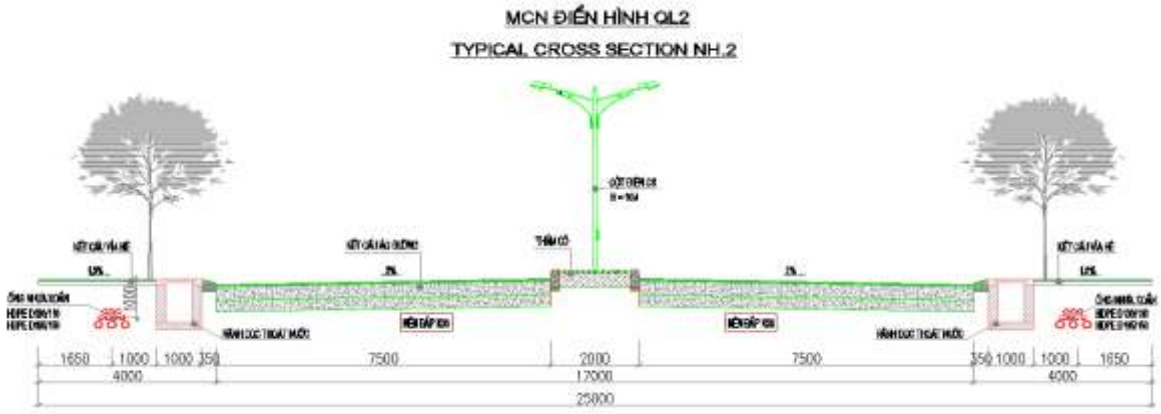
74. Approximately 1.23 km of National Road #2 will be upgraded where the highway enters the city from the south (Figures 30, 40, and 41). National Highway # 2 functions as the single major access route to the city from the south of the country. The section to be upgraded is in a poor condition and unsuitable for steadily increasing traffic. There are currently no sidewalks for pedestrians.

75. The proposed upgrading will improve the existing dual 7.5 m lane carriageway within a 25m right-of-way (RoW) that are separated by a 2m planted median strip with 4.5m of sidewalk (pavement) area on both sides. The alignment will incorporate tree planting areas and lighting. The drainage of the road will include passive drainage bioswales (Figure 42). The upgraded section of national road #2 will connect to the new bridge across the Lo River to the new ring road bypass of the city (see below).

Figure 40. Section of National Road #2 along shore of Lo river

Figure 41. Section of National Road#2 to be upgraded

Figure 42. Proposed cross section of upgraded National Road #2



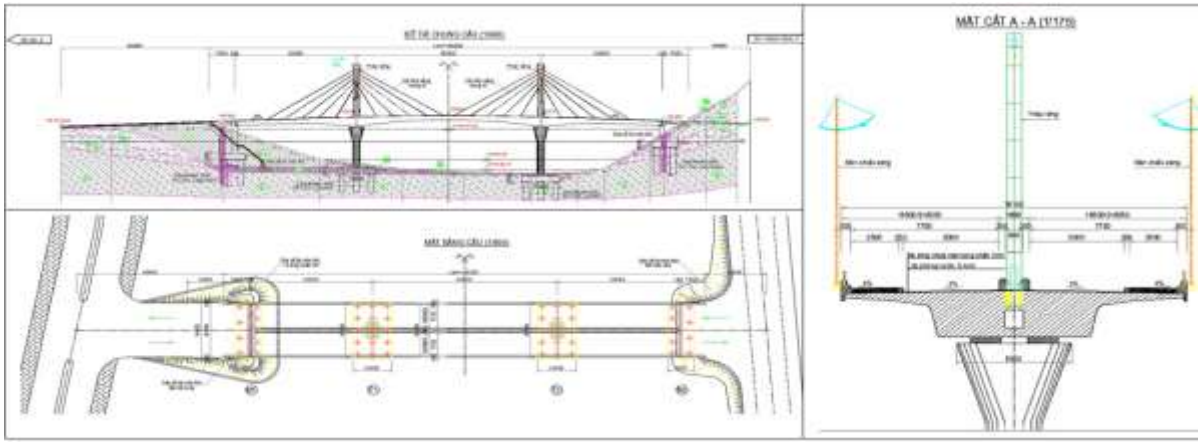
c. Bridge from National Road #2 to Southern Ring Road

76. A new bridge 150m in length and 18 m wide will be constructed across the Lo River from the upgraded section of National Road #2 (Figure 40 and 43). The bridge will connect National Road #2 to a new bypass Ring Road to be constructed along the north side of the Lo River (see below). There is not an existign bridge across the river in the subpoject area.The objectives of the bridge (and Ring Road) are as follows:

1. Enhance connectivity to the city road network;
2. Divert traffic travelling north of city around city to avoid the city centre;
3. Strengthen urban and peri-urban road networks in the south of the city; and
4. By connecting National Road #2 and new Ring Road, enhance connectivity of the north and south of the city.

Figure 43. Site of bridge crossing over Lo river to future Ring Road site

Figure 44. Proposed cross sections of new bridge of Lo river



d. Southern Ring Road

77. As introduced above with the new Lo River bridge and upgrades to National Road 32, a new 2.93 km southern ring road (SRR) will be constructed along the east embankment of the Lo River (Figures 40, and 43). The SRR which will receive the new bridge over the Lo River from National highway #2 to provide a by-pass route around the southeastern side of the city centre.

78. National Highway #2 is the major southern entry to Ha Giang which connects directly to the western part of the city. Most of the traffic connects to the eastern part of the city via the existing bridges over the Lo River including the through traffic to the northern areas of the province. However, the current traffic pattern leads to traffic congestion in the city centre. The bypass Ring Road is needed to shunt north-bound traffic around and away from the city centre. The objectives of the Ring Road are the same as identified for the new bridge including reducing truck traffic through the city.

79. The proposed SRR will have a dual carriageway of 9m with 3.75m of shoulders on either side for a total RoW of 16.5m. The shoulders will provide 2m bicycle lanes where the RoW allows (Figure 45). The selected alignment traverses the steep and wide eastern embankment of the Lo River, flat peri-urban residential areas, urban-residential areas (Figure 46).

Figure 45. Proposed cross section of southern Ring Road

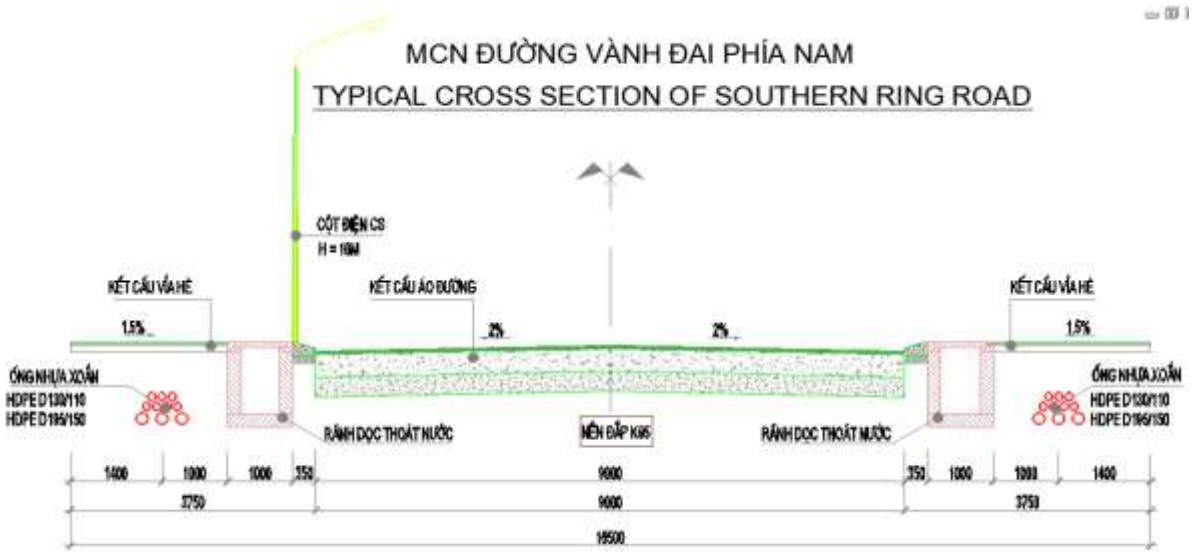


Figure 46. Example sections of alignment of Ring Road

C. Vinh Yen City

80. The original list of subproject components for Vinh Yen city from Volume 3 of the PPTA report[34] are reproduced in Table 5 and located in Figure 47.

Table 7. Vinh Yen subproject components from PPTA report

SC	Subproject component
1	Dredging and landscape Protection of Dam Vac Lake
2	Collection and Wastewater Treatment in West Vinh Yen
3	Tertiary Wastewater Sewers
4	Green Park Development Near Dam Vac Lake
5	Infrastructure for University Area
6	Exhibition/linkage Centre for Business centre

81. Similar to the Hue and Ha Giang subprojects, the components of Vinh Yen subproject have been re- organized into climate resilient urban development and transportation network development component activities. Common component types are further grouped for clarity.

1. Green and Resilient Urban Space Improvement

a. Dredging and Landscape Protection of Dam Vac Lake

82. Dam Vac Lake is the environmental hub of Vinh Yen City (Figures 47-49). The urban lake is used to promote tourism development and recreation activities. The city's plan is to surround the lake with commercial buildings, offices, hotels, resorts, golf courses, parks, squares, and a lakeside promenade. The lake is designed to retain water and regulate the surface water drainage system of the city. There is a need to protect the aquatic environment and the reservoir, and for dredging to increase its retention capacity and reduce local flooding.

83. The surface area of Dam Vac Lake has been greatly reduced over the years as Vinh Yen city accelerated construction of urban areas around Vinh Yen lake. The surface area was over 400 ha in 1990, and now it has shrunk to only 160 ha in the dry season and 180 ha in the rainy season. The city wants to preserve those 180 ha. The lake is currently being used for discharge of domestic wastewater and solid waste which has degraded water quality. Water quality often exceeds the government QCVN standard B for suspended solids (TSS), and periodically standards for dissolved oxygen (DO) and biochemical oxygen demand (BOD). The Phan River drains the Dam Vac Lake to the Cau River.

[34] Footnote 8.

Figure 47. Location of Vinh Yen subproject components

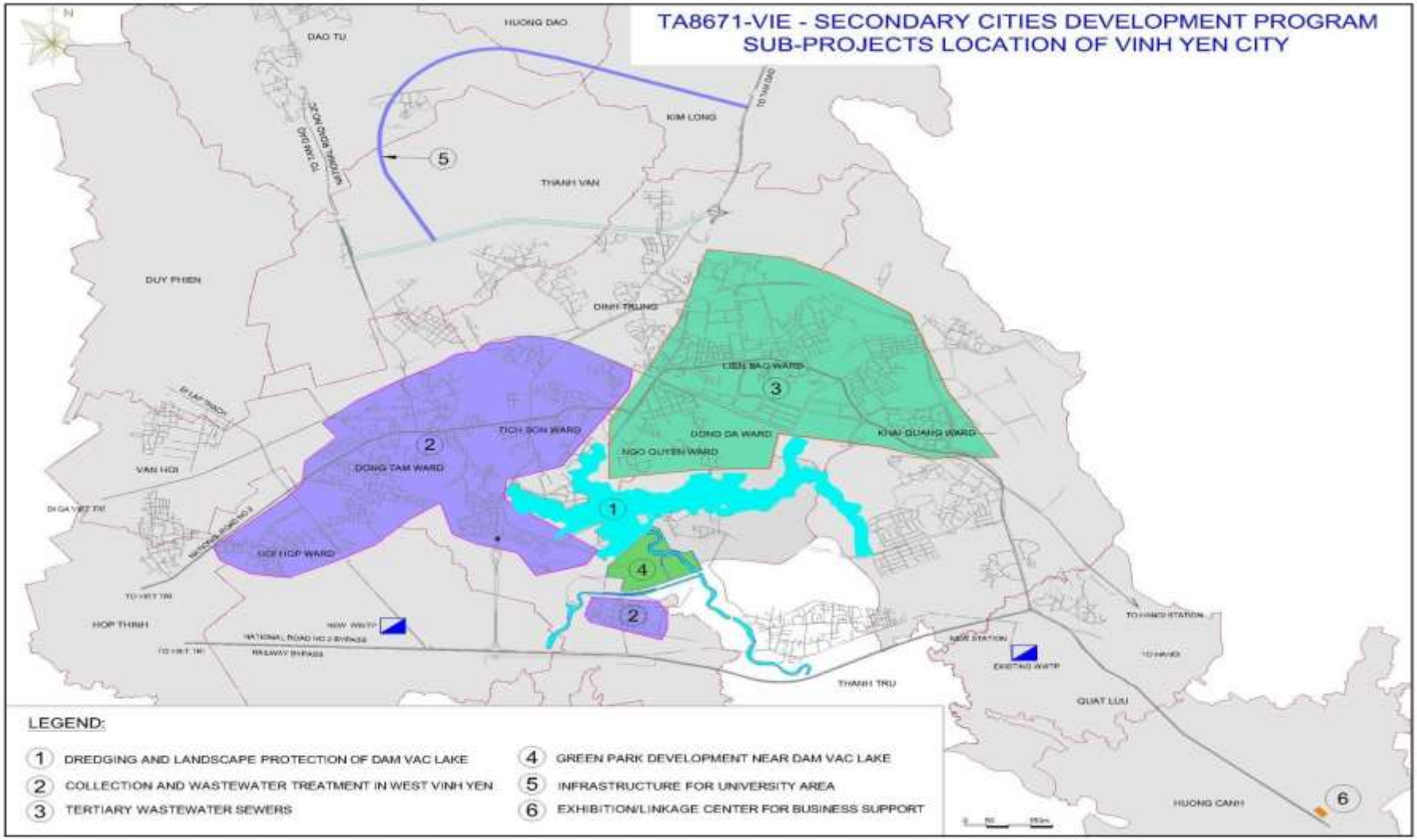


Figure 48. Dam Vac Lake and Phan River (from Figure 47)

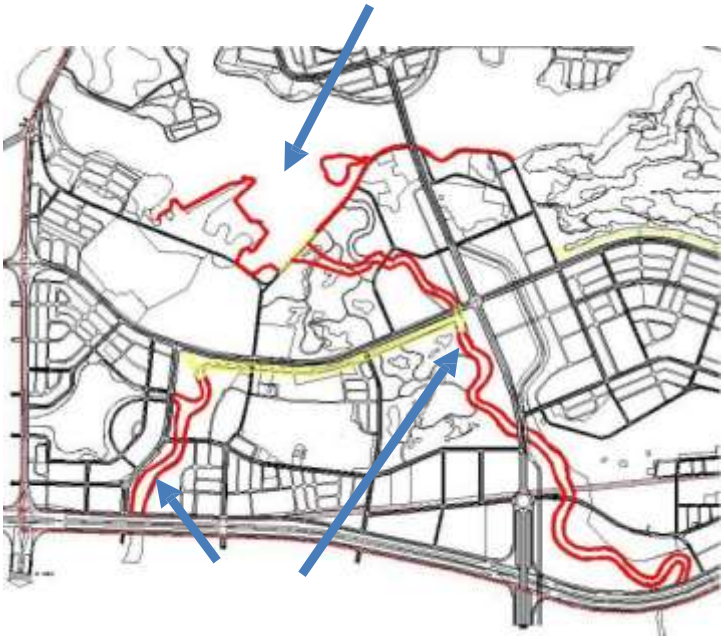


Figure 49. Dam Vac Lake

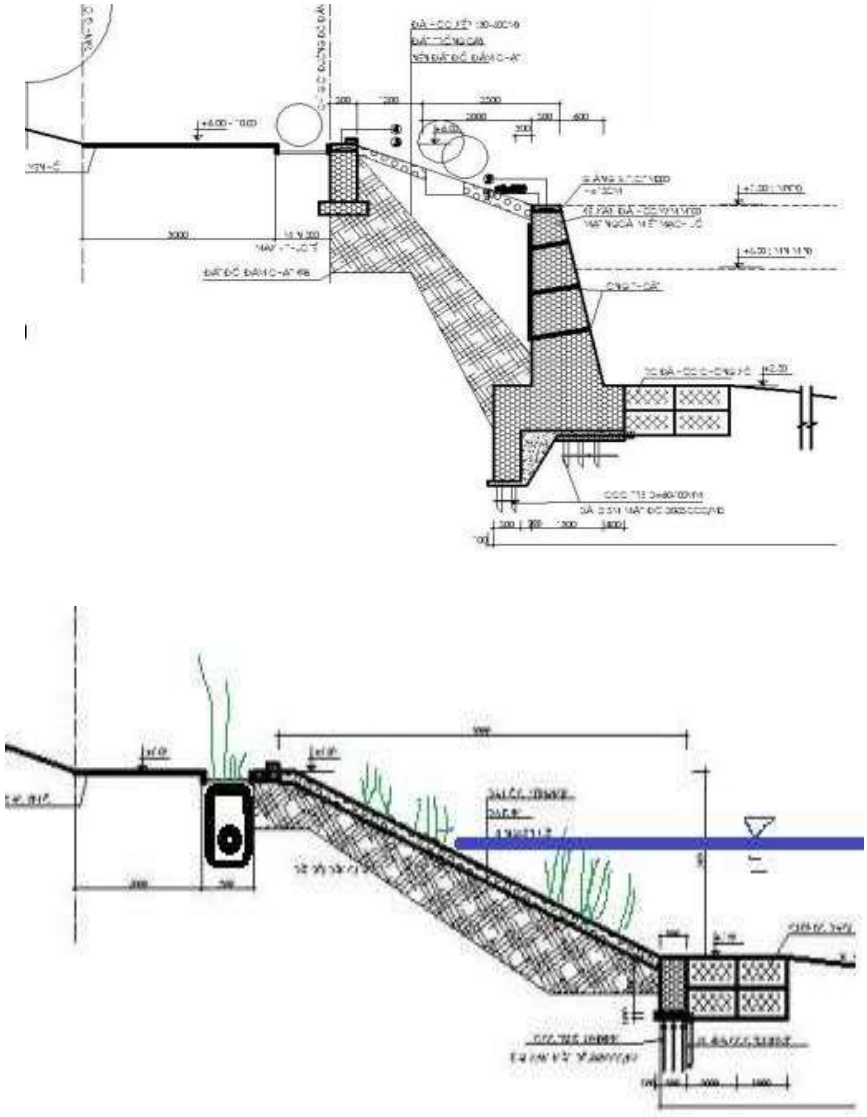
	Dam Vac lake with embankment to be developed in background

	Portion of southern section of Dam Vac lake that will be dredged adjacent to Green Park site (right)

84. The subproject component consists of dredging 60 ha of the southern half of the lake, and developing 3.5 km of embankment around the lake which will include 3.2 km pedestrian walkways, landscaping and lighting (Figure 49). The primary purpose of dredging is to remove the silt to restore the original storage capacity of the lake, and to improve water quality. Phan River will also be dredged to improve flow and water quality. The dredging and embankment component is summarized as follows including the special lake dredging procedure:

- An estimated 789,060m^3 of bottom sediment will be dredged from a bottom area of 460,694 m^2;
- Unlike common open lake dredging operations, dredging of the lake will be conducted systematically across the lake in discrete temporarily diked cells. This will act to contain temporary water quality degradation to the immediate cell, and minimize disturbance to users of the lake during dredging operations;
- The 789,060m^3 of non-contaminted dredgate (see below) will be used for a new infilled Green Park to be developed at the south end of the lake (see component below);
- The development of 3.5 km of pedestrian lake embankment will include vegetated rip rap and stone gabion baskets, and will be landscaping. Average height of embankment will be 5m;
- Dredging of approximately 151,000m2 of the Phan riverbed to a depth of approximately 1.4-3.2 m will occur to produce an estimated 394,773m3 dredgate. Similar to Dam Vac Lake, an estimated 8.6 km of the Phan River embankment will be developed, but to a height of 7.5m which is higher than the lake embankment as means to accommodate increased flow.

Figure 50. Example proposed embankment profiles for Dam Vac Lake and Phan River



b. Collection and Wastewater Treatment in Three Wards of Dong Tam, Hoi Hop, and Tich Son

85. A new wastewater treatment plant (WWTP) and collection network will be constructed for three Wards of the city. The WWTP will be located on approximately 2 ha of agriculture land southwest of the city (Figures 47 and 51). The new wastewater treatment system will supplement the capacity of the recently commissioned (2016) WWTP constructed by JICA. The JICA WWTP collects and treats wastewater from four other of the seven Wards in Vinh Yen (see separate component below).

86. The new system will consist of WWTP with a capacity of 5,000 m^3/d, 27.2 km of primary and secondary network pipeline (DN200–500mm), 30 km of tertiary network pipeline (DN200), 7

booster pumping stations with capacities of 62–185 m^3/h, and 14 small pumping stations with capacities of 6–9 m^3/h. The new WWTP will incorporate aerated, facultative, and treatment lagoons (Figure 52) for secondary treatment. The WWTP will meet government effluent quality criteria (QCVN industrial wastewater standard B for irrigation) for BOD/COD, coliform bateria, TSS, nitrogen, and phosphorus. The final alignments of the collection network, and locations of pumping stations will be determined during detailed design.

87. The treated effluent will meet QCVN industrial wastewater standard B for irrigation, and will be discharged to the Dam Vac Lake via a large irrigation pond (Figure 53). Treatment lagoon sludge will be dried on WWTP property, and disposed in an area approved by the Department of Natural Resources and Environment (DONRE).

Figure 51. Site of new WWTP

Figure 52. plan of new WWTP in southern Vinh Yen

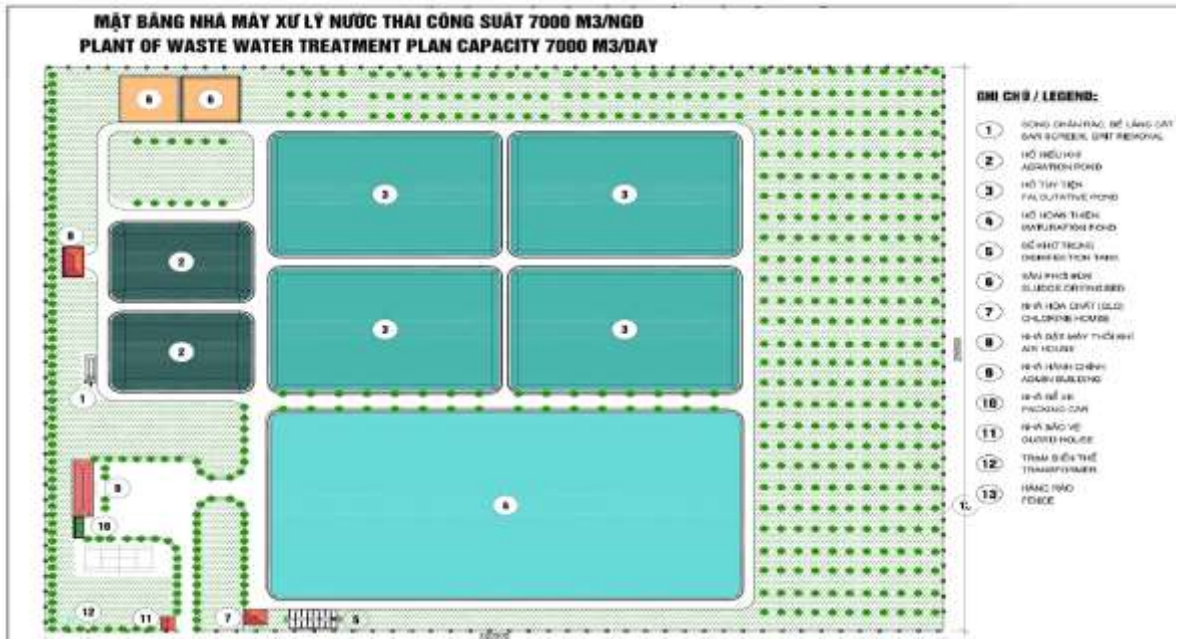


Figure 53. Coi Pond for effluent discharge of WWTP

c. Strengthening Collection Efficiency of Existing Drainage and Wastewater System in Four Wards of Dong Da, Ngo Quyen, Khai Quang, and Lien Bao

88. The capacity of the recently commissioned JICA WWTP in southeastern Vinh Yen (Figures 47 and 54) is expected to be expanded to treat an estimated additional 3,000 m^3/d. Currently, the JICA WTTP treats 5,000 m^3/d of domestic wastewater collected from the Wards of Dong Da, Ngo Quyen, Khai Quang, and Lien Bao. The effluent is treated to meet government QCVN industrial wastewater Standard A before being discharged to the eastern arm of the Phan River below Dam Vac Lake which is used for domestic water use.

89. This component will improve the efficiency of the existing collection system of the JICA WWTP. A new 4.7 km network of open ditches, gravity and pressure wastewater pipes, a 8.9 km tertiary network (DN200–DN250), and 4 small pumping stations with capacities of 6–9 m^3/h will be constructed. The exact locations of the ditches and pipeline network, and pumping stations will be identified at detailed design. Upon completion of the expansion of the collection system, the JICA WWTP will maintain the treated effluent quality to meet QCVN Standard A.

Figure 54. Existing JICA WWTP

d. Green Park Development South of Dam Vac Lake

90. At the south end of Dam Vac Lake, 44.5 ha have been allocated for a Green Park to be developed for tourism and local economic development. The existing area is a collection of ponds used by local residents for poultry husbandry and aquaculture (Figure 55).

Figure 55. Area south of Dam Vac lake for Green Park development

91. This subproject component is integrated with the dredging and embankment development of Dam Vac Lake. The Green Park will include:

- Infill with dredgate from Dam Vac Lake to fill all existing ponds identified for park area,

and raise the area to at least 1m above adjacent including creation of small rolling hills;
- Develop 1-2 existing ponds into wetland areas surrounded by walkways;
- Landscaping including trees, shrubs, grass, lighting, and pedestrian walkways; and
- Public services, and social entertainment facilities;

Figure 56. Conceptual layout of Green Park at south end of Dam Vac Lake

92. The conceptual landscape design includes the following 3 main use zones:

- Entrance gate and services;
- Children play zone; and
- Green natural zone

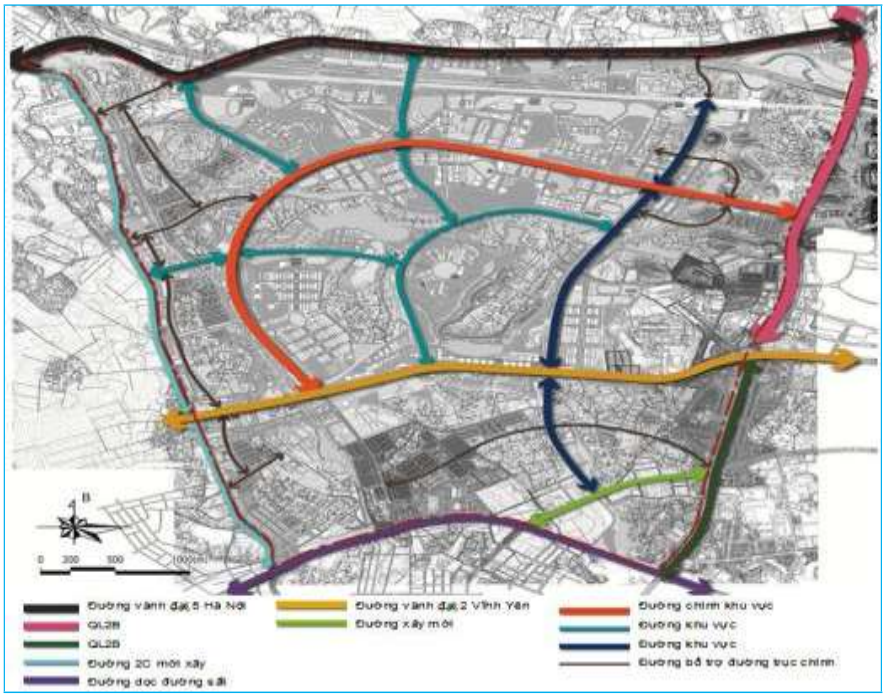
93. The pedestrian and bicycle paths will have LED lighting, the park will have central irrigation, and furniture for recreation and sports will be provided. The park will have toilets, restaurants, education area, and a stage for public shows.

2. Economically Competitive City Development

a. Infrastructure for University Area

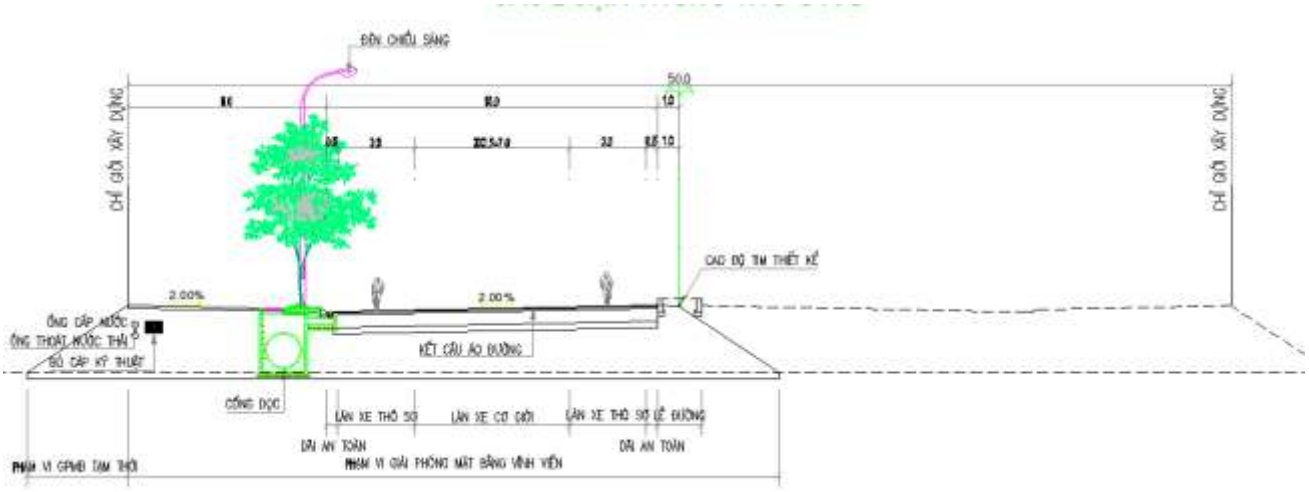
94. A large area north of Vinh Yen City has been zoned for a multi-University development (Figures 47 and 57). The subproject will construct a paved 5.6 km arterial road with a 25m RoW, stormwater drainage & bioswales, streetlights, and sidewalks.

Figure 57. Area plan of University development north of Vinh Yen



Arterial road is identified in orange/brown in Figure 55

Figure 58. Proposed cross section of arterial road



95. The arterial road will traverse a mix of different land uses defined by agriculture, small hamlets, and existing smaller roads sections (Figure 59).

Figure 59. Example environments traversed by arterial road

b. Exhibition/linkage Centre for Business Support

96. A Center for Industrial Production & Business is planned in Huong Canh Town in Binh Xuyen District to showcase goods and services available locally to the market. The Centre will also act as an incubator for green technology industries. The 1.27 ha centre which is located southeast of Vinh Yen (Figure 47)) will provide 3,700 m^2 floor space on two stories (Figure 60). The centre will include approximately 2,000m^2 exhibition hall, 850m^2 of training space, gardens, parking. The center will be connected to the municipal solid waste and wastewater collection system. The Center will meet EHS General Guidelines (2007) requirements for building design, operation, and fire prevention.

97. Key functions of the Centre are as follows:

1. Introduce products of green producing sector in the province, manufacturing technology-related products to customers at home and abroad. Regularly survey, assess and provide information on the manufacturing industry in the province and adjacent objects of interest;

2. Provide technical support, consult and encourage domestic enterprises to invest

in the province, connect and contribute to building a key economic network in the North. Consult and support foreign investors in Vietnam;

3. Connect the province with local, national and international markets; Support in building effective networks;

4. Connect with training University centres to train future workforce for green producing units.

5. Introduction of waste reuse/recycling strategies for businesses in industrial zones and as an input of the reuse cycle for other businesses (industrial symbiosis).

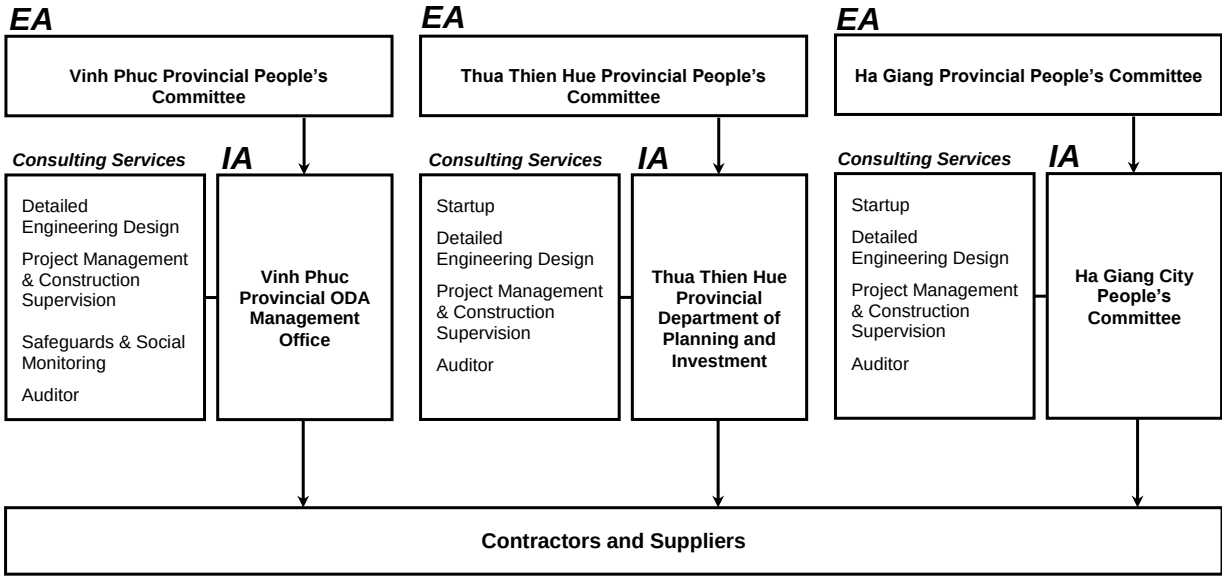
Figure 60. Aerial elevations of Exhibition Centre south of Vinh Yen

D. Project Implementation Arrangements and Schedule

98. Vinh Phuc Provincial People's Committee, the Thua Thien Hue Provincial People's Committee and the Ha Giang Provincial People's Committee will be the **executing agencies** for the projects. Headed by the vice-chairman in-charge, each executing agency is responsible for project coordination with their implementing agency and (i) Oversee project preparation and implementation; (ii) Provide policy guidance during implementation; (iii) Facilitate interagency coordination of all day-to-day management work during project preparation and implementation period; and (iv) Supervise communication with ADB for project management and implementation, reporting project implementation progress, safeguards and social compliance monitoring.

99. Vinh Phuc Provincial ODA Management Office, Thua Thien Hue Provincial Department of Planning and Investment and Ha Giang City People's Committee will be the **implementing agencies** at city level. The implementing agencies have established project management units (PMUs) in charge of all day-to-day management and coordination works during project preparation and implementation. The PMUs will (i) engage detailed engineering design consulting services and prepare for bidding documents; (ii) engage a project startup consultant, a project management and construction supervision consulting service, and auditor; (iii) with the support of the project management and construction supervision consultants, design and procure goods and works under the subproject and administer and monitor suppliers; (iv) undertake contract management, construction supervision and quality control, with the support of supervision

companies; (v) coordinate public consultation and disclosure activities; (vi) coordinate implementation of land acquisition and resettlement activities with relevant departments under the city's people's committee and wad governments; (vii) coordinate implementation of environmental monitoring activities with DONRE; (viii) coordinate project grievance redress mechanism; (ix) coordinate implementation and monitoring of SDAP and GAP; and (x) report on project progress and safeguards implementation, amongst others.
The organizational chart and implementation arrangements are presented below.



Aspects	Arrangements
Implementation period (Construction)	January 2019 – December 2022
Estimated completion date	31 December 2022 (estimated loan/grant closing date: 30 June 2023)
Management	
(i) Executing agency	Vinh Phuc PPC, Thua Thien Hue PPC and Ha Giang PPC
(ii) Key implementing agencies	Vinh Phuc Provincial ODA management office, Thua Thien Hue Provincial Department of Planning and Investment, and Ha Giang City People's Committee
(iii) Project Management Units	A project management unit comprised of technical, safeguards, social, and financial staffs is established under each implementing agency.

ODA = oversea's development assistance; PPC = Provincial People's Committee
Source: Asian Development Bank

Activities	2018				2019				2020				2021				2022				2023	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
A. DMF																						
Output 1: Green infrastructure and climate resilient in Vinh Yen improved																						
1.1 Complete detailed design and approval of the updated EMP and resettlement plan																						
1.2 Complete procurement of consulting service																						
1.3 Complete land acquisition and resettlement activities																						
1.4 Complete procurement of works																						
1.5 Complete works and consulting services																						
Output 2: Green infrastructure and climate resilient in Hue improved																						
2.1 Complete detailed design and approval of the updated EMP and resettlement plan																						
2.2 Complete procurement of consulting service																						
2.3 Complete land acquisition and resettlement activities																						
2.4 Complete procurement of works																						
2.5 Complete works and consulting services																						
Output 3: Green infrastructure and climate resilient in Ha Giang improved																						
3.1 Complete detailed design and approval of the updated EMP and resettlement plan																						
3.2 Complete procurement of consulting service																						
3.3 Complete land acquisition and resettlement activities																						
3.4 Complete procurement of works																						
3.5 Complete works and consulting services																						

B. Management Activities																						
Completed training: procurement, safeguards and social and gender aspects, public finance and anti-corruption																						
Completed training: green and resilience city concept and planning, environmental protection, and community-level support																						
Environment management plan key activities																						
Gender action plan key activities																						
Communication strategy key activities																						
Loan reviews																						
Project completion report																						

IV. DESCRIPTION OF AFFECTED ENVIRONMENTS

A. Hue City

1. Overview

100. Hue is the capital city of Thua Thien Hue province located in North Central Viet Nam. Hue is located on the banks of the Huong River (Perfume River) just a few miles inland from the Viet Nam sea between 16°30''45''-16°24' north, 107°31'45'' - 107°38' east. The city is approximately 700 km south of Ha Noi and approximately 1,100 km north of Hồ Chí Minh City. Hue borders Huong Tra Town in the north and west, Huong Thuy Town in the south, and Phu Vang District in the east. The city is on important transportation routes defined by national highway 1A, the north-south railway, and the marine shipping routes that connect the north and south of Vietnam. With a total land area of about 71.7 km^2 Hue City is administratively subdivided into 27 urban wards.

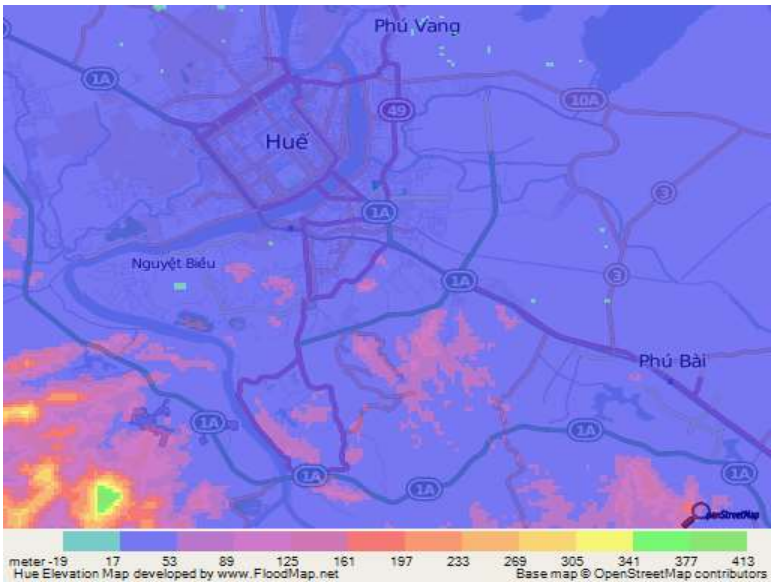
2. Physical Resources

a. Topography

101. Hue city is characterized by the marine coastal area and lagoons in the east, and high mountainous terrain in the west. A portion of the eastern area of the city is very low-lying at a height less than 1.0 msl. The areas around Highway 1A range from 1 to 50 msl (Figure 61). Most of the eastern area is plain experiencing a west-east slope of less than 5%. Conversely, the western area is mountainous with steep eastward slopes above 20%.

102. The subproject components of Hue are located on low-lying areas except for the water supply component in Huong Thuy Town. Huong Thuy is featured will a hilly landscape, which accounts for 76.3% of the area. A narrow plain runs along Loi Nong and Dai Giang Rivers in the east and northeast.

Figure 61. Elevations of Hue city



b. Climate

103. Hue is influenced by the tropical monsoon which affects Southeast Asia throughout with high temperatures and slight volatility. The subproject areas experience two separate seasons with the rainy season from October to March, and dry season between April and September. Prevailing winds are strong and dry from the southwest. Normally, September and October bring heavy rain and occasional typhoons with floodings. Cold winters occasionally occur but are short in duration.

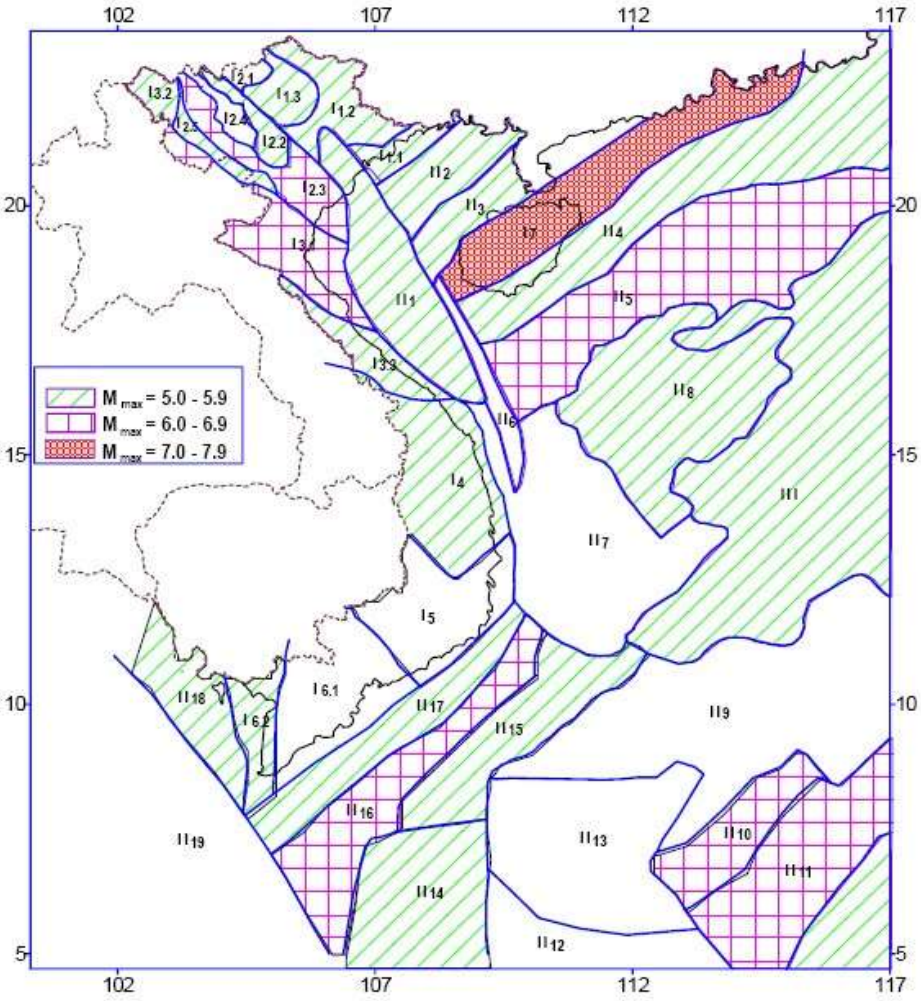
104. The average annual temperature in Hue is about 25.3ºC with the highest temperature of 30.4°C in June, and lowest temperature of 18.7°C in January. Average total annual rainfall is 2,104 mm, which is greatest between November and December ranging from 550 to 775 mm/month, and the lowest in April to June ranging from 5.3 to 20 mm/month. Avarage number rainy days are 120 accounting for 33% of year.

105. Humidity averages 84% annually with the highest levels from October to April ranging from 86 to 96%, and the lowest levels between June and July from 72 to 84%. Hue receives an average of 2,156 hours of sunlight annually, with highs between 234 and 277 hours per month in May and June, and lows between 29 and 120 hours per month in November and December.

106. The prevailing wind directions in Hue are north, east and northeast from October to March, and west and southwest from April to September. In the city center, the frequency of calm wind is quite high (30-50%). The average wind speed in the city in 2014 was 1.4 m/s which was similar to previous years. The average wind speed varies from 2.3 to 2.7m/sec. Storms frequently occur from August to October. Though, no storm has been recorded in recent years while in other years up to 3-4 hurricanes have occurred. The highest average wind speed of storms and tropical depression ranges from 15 to 20 m/s.

c. Seismicity

107. Viet Nam is located on the Eurasian Plate close to the Andaman-Sumatra-Myanma plate boundary. A number of faults have been found in Northern Viet Nam. The most active fault with a maximum shaking intensity of 8-9 (MSK scale) is LaiChau- DienBien-SongMa-SonLa, located in the Northwestern part of Viet Nam (Nguyen 1996). Seismic studies by the Viet Nam Institute of Geophysics (VIG) has established a seismic zoning map in Viet Nam as documented below.



108. Based on this map, Hue City is located in the zone with index I.3, with maximum earthquake risk of 5.0-5.9. In the last 10 years, no earthquake occured in Hue City, whereas some earthquakes occurred in A Luoi District, 70 km away with the maximum magnitude of 3.5 on the Richter scale.

d. Air quality, Noise

109. Air quality in the subproject area was measured as part of the national EIA of the subproject by the project owner (12-16 April 2016). Air quality sampled met all national ambient air quality standards (QCVN 05-2013) including noise (QCVN 26-2010) as well as WHO ambient air and noise quality guidelines (Table 6).

110. For convenience of reporting the relatively widely spread Hue subproject is divided into four distinct areas to summarize ambient environmental quality. The four areas of the Hue subproject are defined below from Figure 1 (from Project Description).

1. Adjacent & inside Citadel;
2. An Van Duong Development Area;
3. Southeast Road upgrades; and
4. Water supply component

111. Table 6 indicates that air quality in Hue when the EIA was conducted was good, and in accordance with the annual air quality information published by the Hue DONRE in the Hue Province Annual Environmental Monitoring Report for 2015. Concentrations of air pollutants associated with combustion of fossil fuels such NO_2, CO and SO_2 are very low and several times less than the standards. The noise levels did exceed permissible national limits for sensitive sites, as well as the WHO standard for residential areas (55 dB), but complied with the national standard for residential areas.

Table 8. Ambient air and noise quality in Hue City

Parameters		**TSP µg/m³**	**PM_{10} µg/m³**	**Pb µg/m³**	**CO µg/m³**	**SO_2 µg/m³**	**NO_2 µg/m³**	**Noise dB**
Citadel (30 sites)	Max	160.9	<30	<0,15	4.511	45.4	36,2	66.7
	Ave	116,1	<30	<0,15	3.061	26,6	20,7	64.2
	Min	85	<30	<0,15	2.271	20	15,3	60.7
An Van Duong (18 sites)	Max	134.3	<30	<0,15	4.260	40.5	31.2	68
	Ave	103.3	<30	<0,15	2.867	23.9	18.6	65
	Min	85	<30	<0,15	2.217	20	15	63
Road Upgrades (4 sites)	Max	149.6	<30	0,18	3.790	35.1	21.3	67.7
	Ave	121.2	<30	<0,15	3.506	22.4	16.4	63.2
	Min	92.5	<30	<0,15	2.762	20	15	60
Water Supply (2 sites)	Max	85	<30	<0,15	2.640	<20	<15	59.7
	Ave	85	<30	<0,15	2.524	<20	<15	58.5
	Min	85	<30	<0,15	2.348	<20	<15	58.3
QCVN 05:2013/BTNMT for a hour		300	150	1,5	30.000	350	200	
QCVN 26:2010/BTNMT								55 – 70 (*)
WHO noise guidelines								45 – 55 (**)

(**) Noise level of IFC's EHS guildlines

Receptor	**One Hour L_{Aeq}(dBA)**	
	Day Time 07:00-22:00	Nightime 22:00-07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

(*) Noise level of QCVN 26/2013

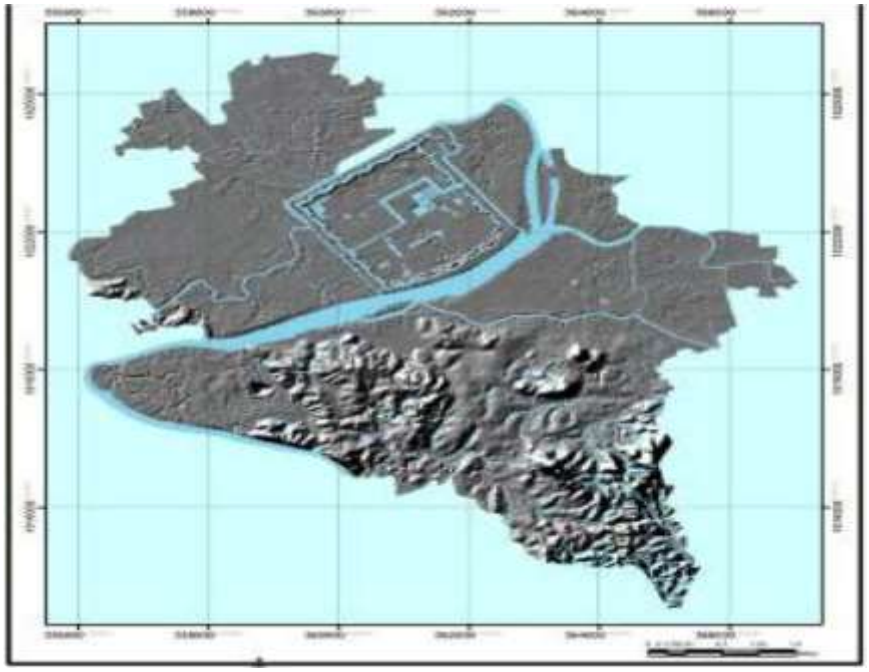
Receptor	**One Hour L_{Aeq}(dBA)**	
	Day Time 06:00-21:00	Nightime 21:00-06:00
Educational, Healthy, library, pagoda, church	55	45
Residential, housing, institutional, hotel, commercial	75	55

e. Main Hydrology

112. Hue City is directly affected by the hydrological regime of the Huong River system which is the largest river system in Thua Thien Hue province. The Huong River has three main tributaries; the Bo, Ta Trach and Huu Trach, which originate from the slopes of the Truong Son range (Figure 62), and which flow through the center of Hue City. The Huong River basin is 2,830 km^2 which is 56 percent of the area of the province. The main channel of the Huong River is 104 km long at an average elevation and gradient of 330m and 2.85 percent, respectively.

113. South of the Huong River there are interconnected branches of the An Cuu and Nhu Y Rivers as well as the Phat Lat Canal which create a complete natural drainage network. North of the Huong River are the Bach Yen and An Hoa River branches and the Ngu Ha and Ho Thanh Hao Rivers as well as a series of interconnected lakes that function as natural flood moderators for the Citadel area.

Figure 62. Hydrological network of Hue City 2009 (from GIS Data)



f. Flood sensitive areas

114. The central area of the city was built on a narrow strip of downstream floodplain of the Huong River. The Citadel area has an elevation of +1.8 msl to +3.5 msl. Phu Hiep and Phu Cat Wards have an elevation of 2.7m to 3.5m. Areas with elevation of less than + 2.0m are frequently flooded. The southern area of the city is on a relatively broad elevation range of +2.5m to +7.5m. There are flat hills in the area between +12.0m and +18.0m, in contrast to local rice fields and lakes/ponds with elevations <+1.5m.

115. Periodic flooding is caused by combinations of high river levels, sea level rise – storm surge, and local accumulation of rainwater. The key determining factors are: (i) the basin configuration in in which three main rivers with mountainous headwaters converge to a flat plain; (ii) a complex drainage network (rivers, streams, canals); and (iii) very heavy rainfall events such

the monsoon or and typhoons that produce produce high intensity rain. The Tam Giang Lagoon east of Hue at the ocean is an aggravating factor, because in case of a flood the lagoon acts as a reservoir that inhibits outflow of flood water to the sea.

116. In the last 40 years at least five recorded rainfall events have generated a water level in the Huong River of 4.50 m as recorded at the at Kim Long gauge station 2 km upstream of the city. The most severe recorded flood event occurred November 1-6, 1999 producing river level of 5.81 m at Kim Long station. According to the elevation and the flooding history, most parts of the city are flood sensitive due to low elevations.

g. Local water resources

117. As introduced above the main surface waters of Hue City consist of the Huong River and the local An Cuu and Nhu Y tributaries from the south along with numerous connected drainage canals and ponds located inside and outside the Citadel. All surface waters of the city drain eastward to the Tam Giang lagoon before draining to the Viet Nam Sea.

118. Hue City supports numerous 48 small lakes and ponds of various sizes including the lakes of Thuan Loc, Thuan Hoa, Tay Loc and Thuan Thanh Wards. In Thuan Loc Ward Tinh Tam, Hoc Hai and Sen (Cay Mung) lakes are located. In Thuan Hoa Ward there are Vo Sanh and Tan Mieu lakes; and Moc Duc and Huu Bao lakes in Tay Loc Ward. Surrounding the Citadel are the inner and outer Kim Nguu lakes.

119. Groundwater aquifers are distributed throughout the city with depths varying from 12m to 22m. The amount of water in each aquifer ranges from poor to average depending on its source. The water is fresh with static levels is shallow ranging varying from 0.1m to 5.5m. 100 percent of people within the project area are using water from Hue city's water treatment plans exept those people in Phu Son Commune, Huong Thuy District who are using rainwater for domestic purposes.

120. Water supply capacity in Hue is good. The National Centre for Rural Water Supply and Sanitation in 2008 rated the water supply in Hue City to be high at approximately 95 percent supply safety. Raw water is taken from the Huong River for the Van Nien, Quang Te 1, Quang Te 2 and Da Vien water treatment plants.

h. Surface water quality

121. Surface water quality was sampled at several sites in the subproject areas as part of the national EIA (12-17 April 2016). Table 7 summarizes the water quality at the 39 sites sampled. The surface water quality sites are divided into the same 4 subproject areas.

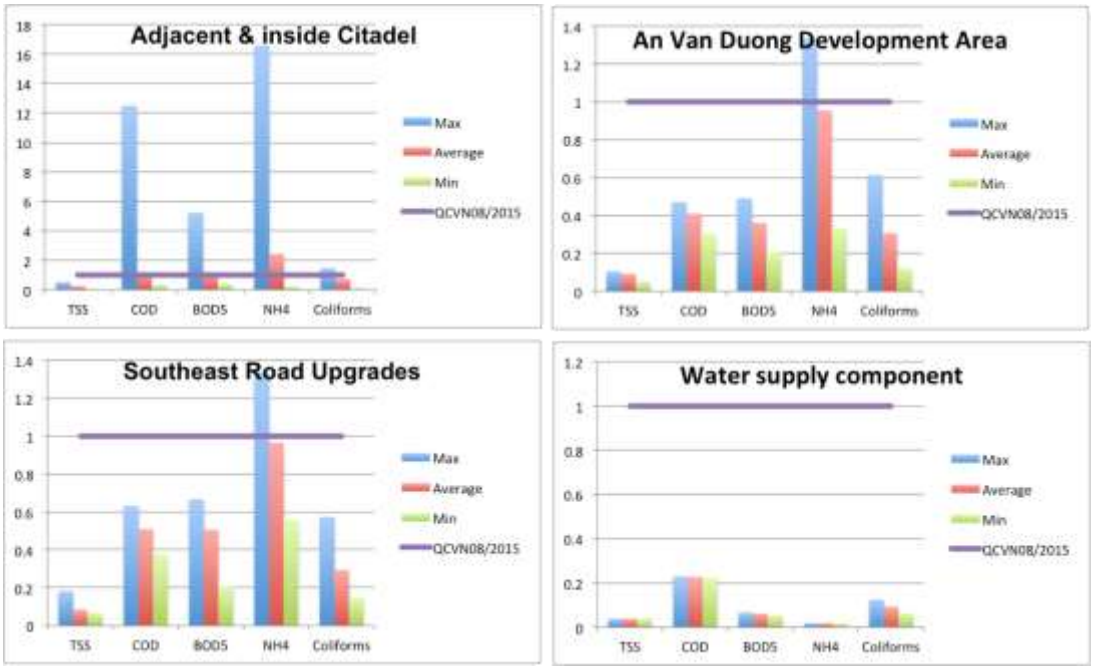
Table 9. Surface water quality

Subproject Site	Water Quality Summary	pH	TSS (mg/l)	COD (mg/l)	BOD5 (mg/l)	NH_4+ (mg/l)	Oil and greasee (mg/l)	Coliforms (MPN/100ml)
Citadel (27 sites)	Max	**10.2**	**26**	**375**	**78.49**	**14.93**	<0.3	**$1.1x10^4$**
	Average	7.6	12.3	**35.6**	**18.2**	**2.2**	<0.3	5600
	Min	7.3	4.1	10.4	6.4	0.2	<0.3	930

Subproject Site	Water Quality Summary	pH	TSS (mg/l)	COD (mg/l)	BOD5 (mg/l)	NH_4+ (mg/l)	Oil and greasee (mg/l)	Coliforms (MPN/100ml)
	22 samples exceeded QCVN standard							
An Van Duong (6 sites)	Max	7.8	5.3	14.12	7.38	**1.2**	<0.3	4600
	Average	7.5	4.6	12.3	5.4	0.86	<0.3	2300
	Min	7.4	2.6	9.17	3.11	0.3	<0.3	930
	2 samples exceeded QCVN standard							
Road Upgrades (4 sites)	Max	7.2	9.1	18.94	10	**1.2**	<0.3	4300
	Average	7.2	4.2	15.3	7.6	0.87	<0.3	2200
	Min	7.2	3.4	11.38	3.11	0.5	<0.3	1100
	a sample exceeded QCVN standard							
Water Supply (2 samples)	Max	6.2	1.9	6.9	1	0.016	<0.3	930
	Average	6.2	1.9	6.8	0.9	0.016	<0.3	695
	Min	6.2	1.9	6.7	0.8	0.016	<0.3	460
	no samples exceeded QCVN standard							
QCVN 08-2015 ***National technical regulation on surface water quality***		**5.5-9**	**50**	**30**	**15**	**0.9**	**1**	**7500**

122. Figure 63 extends the summary of actual water quality data in Table 7 by comparing indices of water quality at the four Hue subproject areas to a composite national QCVN standard. The Y axis in Figure 63 represents actual sample parameter values divided by the QCVN standard which allows the single water quality standard of unity for comparison. Figure 63 indicates that the four areas vary widely with respect to complying with QCVN water quality standards.

Figure 63. Summary of surface water quality and QCVN standards.



123. Adjacent & inside the Citadel area surface water quality at most sites was degraded with COD at 16 of 27 stations exceeding permitted standards. At 14 of 19 stations BOD_5 was high, and NH_4^+ at 22 of 27 stations exceeded the standard. Conversely only at a few of stations coliform exceeded the QCVN standard. The data suggest that poor water quality in the Citadel is due to domestic wastewater discharge.

124. Water quality in An Van Duong area is better with only NH_4^+ exceeding the QCVN standard. The surfaces waters sampled are much bigger rivers inhabited by far fewer people. Surface water quality in the southeast area for the road upgrades is similar to An Van Duong. The sparsely populated water supply component area also supports good water quality.

i. River and lake bottom sediment quality

125. The subproject will dredge a large volume of sediment from select lakes, rivers, and canals that will need to be disposed locally in Hue in pre-selected sites according to a Master Plan for disposal sites[35] which are existing licensed landfills under operation, and sites that are planned to be upgraded to engineered licensed landfills from 2016 to 2020. Sediment quality was assessed as part of the IEE to determine whether the quality of dredged sediment posed an environmental contaminant problem for Hue area. Figure 64 identifies the sediment sampling sites, and Tables 8 and 9 list sampling locations and quality of sediment sampled, respectively. The results indicated that the bottom sediments of lakes, rivers, and canals of Hue are not contaminated.

[35] (23/06/2016). Decision No 1413 – QD UBND on Approving solid management master plan up to 2030 and vision up to 2050.

126. The data in Table 9 show the concentrations of sampled heavy metals in sludge samples and soil samples are many times lower than Viet Nam's standard for sediment quality (QCVN 43:2012/BTNMT). Therefore, dredged sediment from the lakes is not contaminated and does not require pre-treatment (besides dewatering) before disposal.

Figure 64. Sampling sites for sediment quality in Hue City

Table 10. Location of sediment sampling stations

STT	Code	Location	STT	Code	Location
01	TT_{SKV}	Kẻ Vạn River - at Vạn Xuân bridge ;	07	TT_{HCM}	Sen lake (Cây Mưng lake)
02	TT_{SAH}	An Hòa River - An Hòa bridge.	08	TT_{HTH2}	The moat - Đông Ba bridge
03	TT_{HHB}	Hữu Bảo lake	09	TT_{HXT}	Xã Tắc lake
04	TT_{HV}	Vuông lake	10	TT_{HTH3}	The moat - Thượng Tứ lake

STT	Code	Location	STT	Code	Location
05	TT_{HTB}	Tiền Bảo lake	11	TT_{HPT}	Phong Trạch lake
06	TT_{HTH1}	The moat - Cửa Hậu bridge	12	TT_{HTH4}	The moat - Cửa Hữu bridge

Table 11. Sediment quality of Hue city

Parameters	Unit	TT_{SKV}	TT_{SAH}	TT_{HHB}	TT_{HV}	TT_{HTB}	TT_{HTH1}	QCVN 43:2012/ BTNMT
Cd	-	<0,7	<0,7	<0,7	<0,7	<0,7	<0,7	3,5
Pb	mg/kg	<13,8	14,47	<13,8	47,40	<13,8	<13,8	91,3
Zn	mg/kg	24,20	51,80	28,40	-	41,10	50,50	315
Fe	mg/kg	9.740	20.283	16.005	8.562	12.073	28.879	-
As	mg/kg	3,50	7,34	2,89	3,35	4,59	11,65	17,0
Hg	mg/kg	0,033	0,053	0,054	-	0,091	0,159	0,5
DDT	mg/kg	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	$4,8.10^{-3}$
Parameters	**Unit**	**TT_{HCM}**	**TT_{HTH2}**	**TT_{HXT}**	**TT_{HTH3}**	**TT_{HPT}**	**TT_{HTH4}**	**QCVN 43:2012/ BTNMT**
Cd	-	<0,7	<0,7	<0,7	<0,7	<0,7	<0,7	3,5
Pb	mg/kg	22,07	57,90	22,07	26,59	<13,8	24,10	91,3
Zn	mg/kg	100,1	295,1	32,30	97,60	41,0	304	315
Fe	mg/kg	15.713	15.560	8.559	13.277	6.597	16.042	-
As	mg/kg	5,67	5,18	2,38	8,26	11,58	8,27	17,0
Hg	mg/kg	0,287	0,326	0,066	0,291	0,108	0,124	0,5
DDT	mg/kg	-	-	<0,001	<0,001	-	<0,001	$4,8.10^{-3}$

3. Monitoring for Environmental Management Plan

127. A smaller subset of the many sites sampled for air quality (including noise) and water quality by the national EIA will be considered for the monitoring program of the Environmental Management Plan (EMP) for the Hue subproject. The subset of potential sampling sites from the national EIA for the EMP are identified in Figure 65, and Table 10.

Figure 65. Potential surface water and air quality monitoring stations for EMP

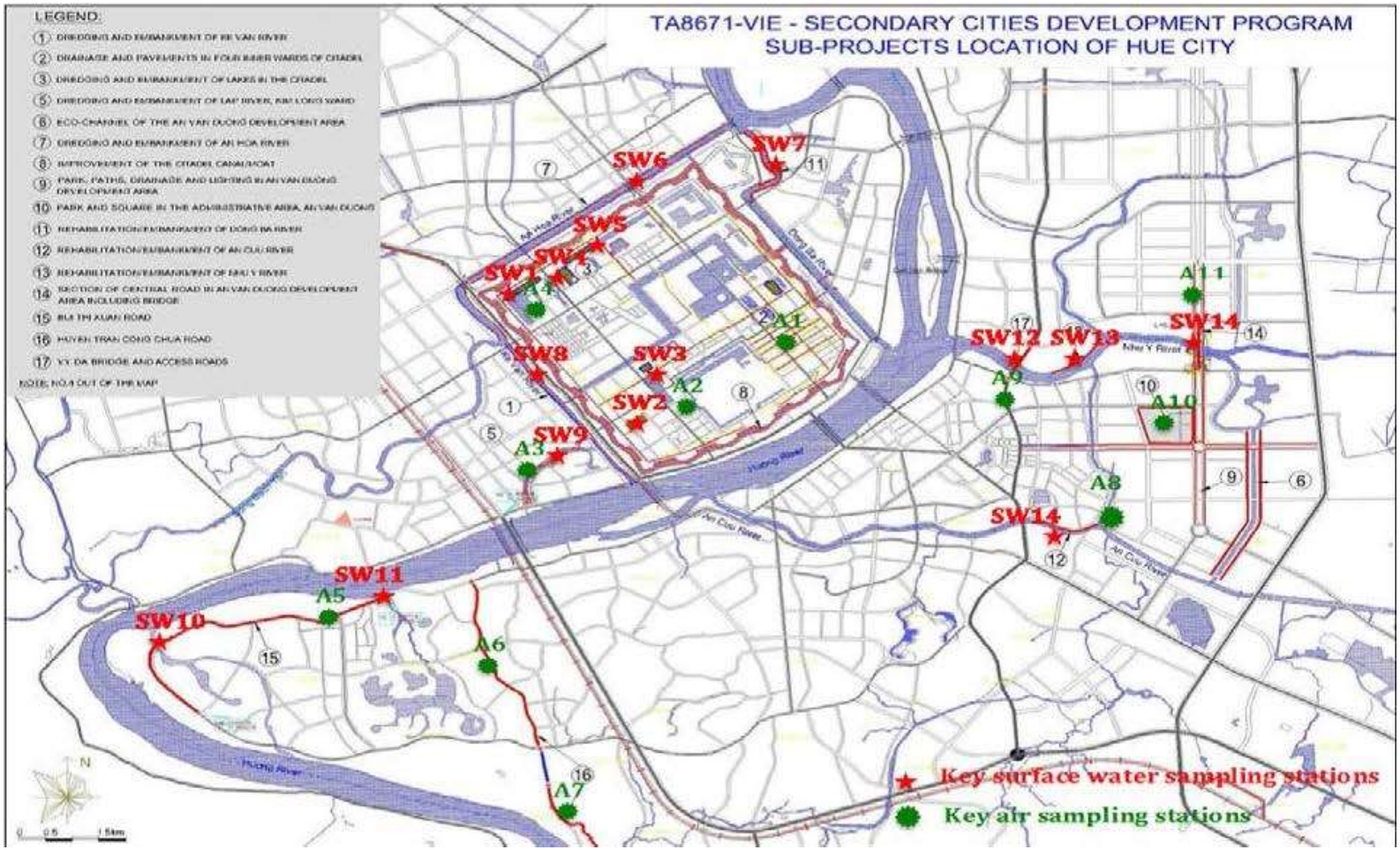


Table 12. Air and water quality monitoring sites for EMP.

Map Code	Location	Parameters	Parameters exceeding QCVN Standard during EIA
Surface water quality			
SW1	Tien Bao Lake	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	BOD_5, NH_4^+,
SW2	Xa Tac Lake	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	n/a
SW3	Phong Trach Lake	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	COD, BOD_5, NH_4^+, Coliform
SW4	Vuong Lake	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	NH_4^+,
SW5	Huu Bao Lake	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	COD, BOD_5, NH_4^+,
SW6	An Hoa River	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	NH_4^+,
SW7	Dong Ba River	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	-
SW8	Ke Van River	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	COD, BOD_5, NH_4^+,
SW9	Lap River	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	COD, BOD_5, NH_4^+, Coliform
SW10	Canal crossed by Bui Thi Xuan road	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	n/a
SW11	Canal at the beginning of Bui Thi Xuan Road	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	n/a
SW12	Nhu Y river at proposed bridge component #17	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	n/a
SW13	Nhu Y river at proposed embankment component #13	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	n/a
SW14	An Cuu River at proposed embankment component #12	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	NH_4^+,
SW15	Nhu Y river at proposed bridge component #14	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	n/a
Air ambient quality (including noise)			
A1	Residential area at component #2	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a
A2	In forbidden palace of Citadel	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a

Map Code	Location	Parameters	Parameters exceeding QCVN Standard during EIA
	at location closest to project construction activities		
A3	Residential area near dredging & embankment components close to Citadel	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a
A4	Residential area next to lake dredging & embankment components within Citadel	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a
A5	Residential area along Bui Thi Xuan road	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a
A6	Residential area along Huyen Tran Cong Chua road	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a
A7	Residential area along Huyen Tran Cong Chua road	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a
A8	Residential area near An Cuu river embankment component	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a
A9	Residential area near proposed access road to Nhu Y bridge	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a
A10	Area of proposed to parkland of component #9 & 10.	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a
A11	Residential area along proposed central road of component #14	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	n/a

4. Ecological Resources

128. The province of Thua Thien Hue has three Protected Areas which are more than 40 km away from Hue city. Within the protected areas of Sao La, Phong Dien, and Bach Ma there are many endangered and endemic wildlife species. Thus, the proposed Hue subproject

components will not affect these protected areas. The Department of Agriculture and Rural Development (DARD) as well as the DONRE confirmed that no project component will encroach or be located nearby any legally protected forest or other critical ecological habitat. The valued natural biodiversity of the province is contained in these protected areas.

129. The subproject area supports urban shade trees (e.g., *Lagerstroemia speciosa*, *Delonix regia, Khaya senegalensis*); fruit trees (e.g., grape fruit, banana, logan, guava); production trees (e.g., *Eucalyptus, Acacia)*; shrub and grass. A few types of birds inhabit Hue city such as bulbul, sparrow, dove, and kingfisher. Terrestrial animal life in the city is restricted to primarily small rodents. The canals and tributaries of the Huong River support subsistence fish species.

a. Forest management

130. The forests of the province are classified into three management types defined by "Protected", "Special Use", and "Production". Only forest classified as production forest is located in the subproject area along the two roads to the Temples of Kings that will be upgraded, and along the proposed alignment of the water supply to be constructed for the outlying villages. The project roads and water supply pipes do not go through these production forest areas.

5. Cultural Resources

131. Established as the capital of unified Viet Nam in 1802, Hue was not only the political but also the cultural and religious centre under the Nguyen dynasty until 1945. As a result, the city is extremely rich in cultural relics of national and international importance. All these relics were included in the Complex of Hue Monuments, recognized as World Cultural Heritage in 1993. This complex includes a series of monuments scattered on a vast area belonging to the territory of Phú Vang district, Hương Trà town, Hương Thủy town and Hue City.

132. The structures of the Complex of Hue Monuments are carefully placed within the natural setting of the site and aligned cosmologically with the Five Cardinal Points (centre, west, east, north, south), the Five Elements (earth, metal, wood, water, fire), and the Five Colours (yellow, white, blue, black, red).

133. The central structure is the Hue Citadel area which was the administrative centre of southern Viet Nam during the 17th and 18th centuries CE. Within the Hue Citadel were located not only administrative and military functions of the Empire, but also the Imperial Residence, the Hoang Thanh (Imperial City), the Tu Cam Thanh (Forbidden Purple City) and related royal palaces. Tran Binh Dai, an additional defensive work in the north-east corner of the Capital City, was designed to control movement on the river. Another fortress, Tran Hai Thanh, was constructed a little later to protect the capital against assault from the sea.

134. Outside the Capital City there are several associated monuments of importance. In the outlying areas were located important ritual sites related to the spiritual life of the dynasty such as the Van Mieu (Temple of Literature), the Dan Nam Giao (Esplanade of Sacrifice to the Heaven and Earth), the Ho Quyen (Royal Area), the Den Voi Re (Temple of the Roaring Elephant), and the Chua Thien Mu (Celestial Lady Pagoda). Further upstream, arranged along the Perfume River were the tombs of the dynasty's emperors.

135. The Complex of Hue Monuments is a remarkable example of the planning and construction of a complete defended capital city in a relatively short period in the early years

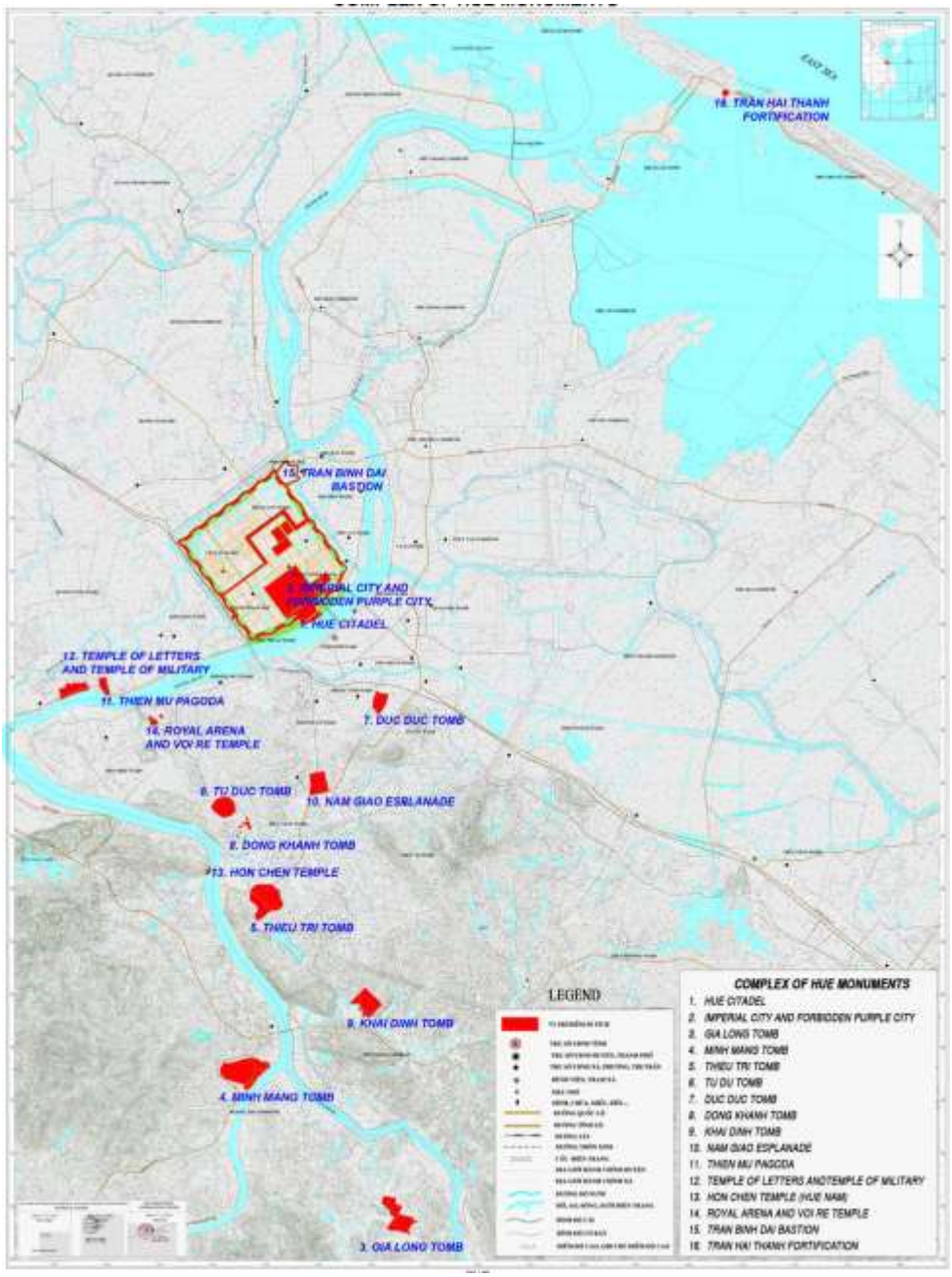
of the 19th century CE. The integrity of the town layout and building design make it an exceptional specimen of late feudal urban planning in East Asia.

136. The cultural resources identified above which are summarized in Table 11 and presented in Figure 66 are near some subproject components. The cultural relics of greatest significance to the project (i.e. in closest proximity) are described in more details below.

Table 13. Location of cultural resources

Cultural Resource	Location in relation to subproject components
The Hue Citadel	Thuan Thanh, Thuan Loc, Thuan Hoa, Tay Loc, Phu Hoa, Phu Binh and Phu Thuan wards of Hue City, buffer zone is 5 m to closest proposed component
Imperial City, Forbidden Purple City	Thuan Thanh and Thuan Hoa wards, Hue City, 500 m to closest proposed component
Tran Binh Dai Bastion	Thuan Loc ward, Hue city next to main wall's moat 800 m to closest proposed component
Coastal Fort	Thuan An Town, Phu Vang district, 20 km to closest proposed component
The Confucius Temple of Letters and Military Temple	Huong Long ward, Hue city and Huong Ho ward, Huong Tra town, 3.5 km to closest proposed component
Nam Giao esplanade	Truong An and Thuy Xuan wards, Hue city. 3km to closest proposed component
Royal Arena, Voi Re temple	Thuy Bieu ward, Hue City, 2 km to closest proposed component
Hue Nam Shrine	Huong Tho commune, Huong Tra Town, 4 km to closest proposed component
Thien Mu pagoda	Huong Long ward, Hue city, 3 km to closest proposed component
Gia Long Tomb	Huong Tho commune, Huong Tra Town, 4 km to closest proposed component
Minh Mang Tomb	Huong Tho commune, Huong Tra Town, 4 km to closest proposed component
Thieu Tri Tomb	Thuy Bang commune, Huong Thuy Town, 6 km to closest proposed component
Tu Duc Tomb	Thuy Xuan ward, Hue city, 500 m to closest proposed component (access from project road to the Tomb via existing access road connecting to project road)
Duc Duc Tomb	An Cuu ward, Hue city, 1.5 km to closest proposed component
Dong Khanh Tomb	Thuy Xuan ward, Hue city, 800 m to closest proposed component
Khai Dinh Tomb	Thuy Bang commune, Huong Thuy Town, 5.5 km to closest proposed component

Figure 66. Location of Hue Cultural Relics (Complex of Hue Monuments)[36]



137. The Imperial City, Forbidden Purple City: The central structure is the Hue Citadel area which was the administrative centre of southern Viet Nam during the 17th and 18th centuries CE. Within the Huế Citadel were located not only administrative and military functions of the Empire, but also the Imperial Residence, the Hoang Thanh (Imperial City), the Tu Cam Thanh (Forbidden Purple City) and related royal palaces. Tran Binh Dai, an additional defensive work in the north-east corner of the Capital City, was designed to control movement on the river. Another fortress, Tran Hai Thanh, was constructed a little later to protect the capital against assault from the sea. The sites are presently located to the administrative areas of Thuận Thành, Thuận Lộc, Thuận Hòa, Tây Lộc, Phú Hòa, Phú Bình and Phú Thuận wards of Hue city. The site was recognized as the National Monument at the Decision No. 873-QĐ/BVHTT

[36] Thua Thien Hue Provincial People's Committee. 2015. Management Plan of the Complex of Hue Monuments for the Period 2015 – 2020, Vision 2030.

dated May 12, 1997 by the Ministry of Culture, Sports and Tourism. The total area of the World Heritage Property Hue capital city (including the Imperial City and the Trấn Bình Đài bastion) is 1.597.100m^2 and the buffer zone is 719.300m^2 (Figure 67).

Figure 67: The Hue Imperial city, Hue Citadel, Forbidden Purple City (red: core zone; green, bugger zone).[37]

138. Hổ Quyền (Tiger Arena), Voi Re temple are located at Thủy Biều ward, Hue city; recognized as the National Monument at the Decision No. 2009/1998/QĐ-BVHTT dated 26/9/1998 by the Ministry of Culture, Sports and Tourism. The area of the Hổ Quyền-Voi Ré World Heritage Property is 24,531.7m^2.

139. Tự Đức tomb is located at Thủy Xuân ward, Hue city; recognized as the National Monument at the Decision No. 54-VHTT/QĐ dated April 29, 1979 by the Ministry of Culture, Sports and Tourism. The area of the World Heritage Property of Tự Đức tomb is 129,986.8m^2.

140. Dục Đức tomb is located at An Cựu ward, Hue city; recognized as the National Monument at the Decision No. 2890-VH/QĐ dated September 27, 1997 by the Ministry of Culture, Sports and Tourism. The area of the World Heritage Property of Dục Đức tomb is 85,476.7m^2.

141. Đồng Khánh tomb is located at Thủy Xuân ward, Hue city; recognized as the National Monument at the Decision No. 2009/1998-QĐ-BVHTT dated September 26, 1998 by the Ministry of Culture, Sports and Tourism. The area of the World Heritage Property of Đồng Khánh tomb is 22,942.6m^2.

142. The zoning of these sites is presented in **Appendix B**.

[37] Thua Thien Hue Provincial People's Committee. 2015. Management Plan of the Complex of Hue Monuments for the Period 2015 – 2020, Vision 2030.

143. The Complex of Hue Monuments is wholly owned by the Government of the Socialist Republic of Viet Nam. Guided by the 1972 Convention on the Protection of the World Cultural and Natural Heritage, the National Heritage Law (2001, revised in 2009), and a number of other provincial regulations and decisions, the Hue Monuments Conservation Centre (HMCC), placed directly under the Thua Thien Hue Provincial People's Committee, is the institution responsible for the management of the complex and the protection of its outstanding universal value. Staffed by more than 700 people from many different professional backgrounds, this institution deals with all issues including zoning, research, tangible and intangible heritage preservation, traditional material reproduction, visitor management, as well as the planning and protection of the landscape setting and associated features in the buffer zone and immediately surrounding area.

144. The Complex of Hue Monuments is given special attention in the Socio-Economic Development Master Plan of Thua Thien Hue Province, which provides direction for the conservation and restoration of the complex through 2020. An Adjusted Planning Framework for the Complex of Hue Monuments (2010-2020) was approved by the Prime Minister on 7 June 2010. In 2015, the Management Plan of the Complex of Hue Monuments for the Period 2015 – 2020, Vision 2030 was issued. The Management was developed to (i) Identify the risks which potentially cause impacts to the property and propose the strategic objectives, management and conservation policies mitigating those risks; (ii) Propose the key tasks not only in the heritage preservation but also identify the tasks and requirements for concerned government agencies and stakeholders in the implementation of the socio-economic development projects in the province; and (iii) Propose an action plan of heritage preservation which include the clusters of solutions in the period 2015 – 2020 which will be updateable in the five year terms that follow.

a. Land Use

145. The 2012 land inventory report indicates the area of Hue City comprises 1,909 ha of agricultural land (26.6 percent of city area); 5,136 ha of non- agricultural land (71.6 percent); and 24 ha of unused land (1.73 percent). Aside from some cultural heritage property introduced above the only two land types that could be affected by the subproject components are residential and agricultural lands.

146. The rivers and canals (e.g., Ke Van, Lap, An Hoa, Dong Ba) adjacent to the Citadel and the lakes within the citadel are used for drainage and flooding management. Similarly, the local An Cuu and Nhu Y Rivers are also used for drainage and irrigation. These rivers are also used for subsistence fishing and small aquaculture operations.

6. Socioeconomic Profile

a. Population and demographic

147. The population of Hue City in 2011 was 342,550 accounting for 31 percent of the provincial population. Population density in the city is approximately 4,779 people/km^2, which is 22 times greater than the average density province wide. Phuoc Vinh ward in the city has the highest density at 20,705 people/km^2 with lowest city density occurring in Huong Long Ward at 1,411 people/km^2. An Cuu was the most populous Ward with 22,620 people, while Phu Hoa Ward had only 5,792 people. The urban population increased by about 100,000 people in the ten-year period from 2001 to 2011, while the rural population decreased from about 60,000 people in 2001 to about 32,000 people in 2008.

b. Economic and labor structures

148. Hue City has an abundant labor force. In 2011 the number of employees in the economic sectors was about 198,480 people, representing 58 percent of the population (Table 12). Over the past several years, the economic and labor structures have been changing rapidly with an increase in tourism and services and a decrease in industry, handicrafts and agriculture. Employment in the service sector increased from 55 percent in 2005 to 72 percent in 2011, while the agriculture sector decreased rapidly from 17 percent in 2005 to 12 percent in 2011. At the same time, employment in the industrial and construction sectors also decreased from 28 to 15 percent. These figures confirm the importance of the service sector and the importance of its role in the future economic development of Hue City.

Table 14. Employment and changes in labor structure in Hue

Sector	2005		2011	
	Total (people)	Proportion (%)	Total (people)	Proportion (%)
Total	112,413	100	125,714	100
Agriculture, forestry and fishery	16,464	17,31	15,635	12,43
Industry and construction	31,070	27,64	19,188	15,34
Services	61,879	55,05	90,891	72,23

c. Income

149. The average monthly income per capita in Hue is VND 1.7 million (USD 83). The poverty rate in the north central coast region of Viet Nam, where Hue is situated is 21% which is slightly higher than the country's overall poverty rate .

B. Ha Giang City

1. Overview

150. Ha Giang City which is located on the banks of the Lô River in northeast Vietnam at $22^0 24' 48''$ north and $104^0 47'03''$ East, is the capital of the mountainous province of Ha Giang. Ha Giang City is located 20 km south of the Chinese border and approximately 300 km north of Ha Noi. It has a strategic location along National Road No. 2 and connects the northwestern and northeastern mountains provinces. Ha Giang borders Vi Xuyen District in the north, south and west, with Bac Me District the east. The urban area has developed along the Lô River and its main tributary; the Mien River in narrow and steep river valleys with forest-covered slopes prone to landslide and riverbank stability problems. The mountains around the city present an attractive backdrop to the urban area.

151. The city has an area of 135.33 km² and is administratively subdivided into 4 urban wards and 2 communes with total population of 71,689 people. The population is composed of 22 different ethnicities, of which, 566% are Kinh and Tày people.

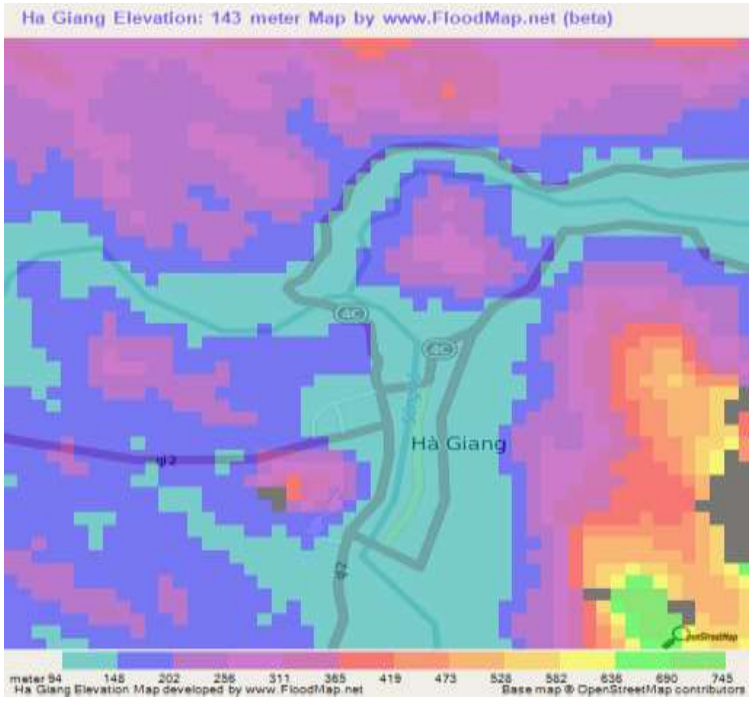
2. Physical Resources

a. Topography

152. The province has a complex terrain and can be divided into 3 zones. The rocky mountainous zone is located close to north tropic with high steep inclines combined with deep valleys and interrupted rivers. Soil sloped mountains in the west belong to the ranges covering Chay River with deep hillsides and narrow streams. The lowlying zone are comprised of valleys floodplain of Lo River and Ha Giang city.

153. The elevation of the subproject area consisting of Ha Giang city and Vi Xuyen district averages from 50 to 100 m while Ha Giang city centre is located on the floodplain of the Lo and Mien rivers which is summarized in Figure 67. The greater Ha Giang area supports forest ranges alternatively along relatively flat valleys along rivers and streams. The dominant grey soils are suitable for growing industrial crops, herbs and fruit trees.

Figure 67. Elevations of Ha Giang city and Vi Xuyen district.



b. Climate

154. Ha Giang experiences a tropical monsoon mountainous climate characteristic of north of Viet Nam. However, Hoang Lien Son mountain provides local cooler temperatures than other provinces of northeast, but also warmer temperatures than the northwest provinces. Annual average air temperature is between 21.6°C and 23.9°C. Maximum summer temperatures have reached 40°C (June, July) with January temperatures recorded as low as 2.2°C.

155. Rainfall in Ha Giang is plentiful. The province achieves an average annual rainfall of about 2300-2400 mm with Bac Quang receiving more than 4000 mm. Rainfall fluctuates widely among regions, years, and months of the year. In particular, the boundary between the dry season and the rainy season is not clear in Ha Giang. Rainfall is typically abrupt and strong in Ha Giang which leads to local flash flood events. The area experiences a high number of

thunderstorms up to 103 days / year with drizzle and fog.

156. Average annual humidity is 85% within a narrow range. The highest humidities of 87-88% are reached from June - August) at about 87 - 88%, with the lows of 81% occurring in February and March). The province is notable for extensive cloud cover and little sunshine.

157. Wind direction is variable due to the topography. In the Lo River valley southeast winds dominate throughout the year, whereas winds in elevated areas are variable. Average wind speed in Ha Giang city is about 1 - 1.5 m/s.

c. Seismicity

158. Based on the zoning map for maximum credible earthquakes in Viet Nam (see Hue section above), Ha Giang City is located in the zone with index I1.3. The maximum earthquake observed is 5.0-5.9. Ha Giang city,about 100 km far along the most active fault Lai Chau – Song Ma – Son La. In the last 10 years, no earthquake occured in Ha Giang City, but some earthquakes occured in Dong Van District, 150 km away with the maximum magnitude of 4.5 on the Richter scale.

d. Air quality

159. Air quality in the Ha Giang was measured as part of the national EIA of the subproject. A summary of sampling sites is provided in Table 13. Air quality sampled was analyzed and compared to national ambient air quality standards (QCVN 05-2013) and the national standard for noise (QCVN 26-2010) as well as WHO ambient air quality guidelines (Table 14).

Table 15. Location of air quality samples

Location	Code	Coordinates
Chang stream spillway	KK1	22°83′ 74″ N, 105° 01′ 26″ E
Cau Moi Bridge	KK2	22°83′ 74″ N, 105° 01′ 26″ E
Southen Ring road	KK3	22°83′ 74″ N, 105° 01′ 26″ E
The proposed landfill	KK4	22°83′ 74″ N, 105° 01′ 26″ E
Canal T2, Minh Khai ward	KK5	22°83′ 74″ N, 105° 01′ 26″ E
Canal T3, Residential group No 20,21,22 of Minh Khai ward	KK6	22°83′ 74″ N, 105° 01′ 26″ E
Canal T4, residential group No 20,21,22 of Minh Khai ward	KK7	22°83′ 74″ N, 105° 01′ 26″ E
Canal T4, residential group 14,15,9,16,17 of Tran Phu ward	KK8	22°83′ 74″ N, 105° 01′ 26″ E
Phong Khoang bridge	KK9	22°83′ 74″ N, 105° 01′ 26″ E
Canal T1, residential group 6 of Quang Trung ward.	KK10	22°83′ 74″ N, 105° 01′ 26″ E
At the location proposed for westen embankment of Lo river	KK11	22°83′ 74″ N, 105° 01′ 26″ E

Location	Code	Coordinates
At starting point of the proposed embankment for Me stream	KK12	22°83′ 74″ N, 105° 01′ 26″ E
Xuan Thuy road	KK13	22°83′ 74″ N, 105° 01′ 26″ E
Phung Hung road	KK14	22°83′ 74″ N, 105° 01′ 26″ E
At crossroad Quyet Thang – Son Ha Ha road with National highway 34.	KK15	22°83′ 74″ N, 105° 01′ 26″ E

160. Table 14 indicates that air quality in Ha Giang when the EIA was conducted was good. The results are consistent with the annual air quality data published by the Ha Giang DONRE in the annual environmental monitoring report of 2015. No sample exceeded national or international standards. Concentrations of air pollutants associated with combustion of fossil fuels such NO_2, CO and SO_2 are low and several times less than the permitted standards. The noise levels did exceed permissible national limits for sensitive sites, as well as the WHO standard for residential areas (55 dB), but complied with the national standard for residential areas.

Table 16. Ambient air quality in Ha Giang City

Parameter	**KK1**	**KK2**	**KK3**	**KK4**	**KK5**	**KK6**	**KK7**	**KK8**	**QCVN05/2013/BTNMT**
TSP (μg/m³)	96.0	96.7	123	*138*	115	110	98	86	300
PM10 (μg/m³)	31.2	31.4	35.6		35.1	34.2	15.7	15.6	150
Pb (μg/m³)	0.38	0.39	0.45		0.41	0.43	0.25	0.24	1.5
CO (μg/m³)	2600	2800	3250	*3380*	2090	2450	2510	2460	30000
NO2 (μg/m³)	29	31	36.7	*39.0*	28.5	29.0	28.7	27.9	200
SO2 (μg/m³)	22.3	22.5	28.4		23.0	23.5	22.7	22.3	350
Noise (db)	58.4	58.9	67.8		58.3	59.6	58.0	56.6	55-70 (QCVN 26/ 2010/BTNMT) 45-55 (WHO Guidelines)
Parameters	**KK9**	**KK10**	**KK11**	**KK12**	**KK13**	**KK 14**	**KK15**	**KK16**	**QCVN05/2013/BTNMT**
TSP (μg/m³)	106	88.9	93.1	*129*	118	121	133	106	300

PM1 (μg/m^3)	36.2	30.5	30.8	*38.8*	35.3	38.0	39.2	36.2	150
Pb (μg/m^3)	0.39	0.31	0.31	*0.36*	0.32	033	0.39	0.39	1.5
CO (μg/m^3)	3100	2500	2450	*2720*	2680	2700	2850	3100	30000
NO2 (μg/m^3)	36	26	26.5	*28.2*	27.9		29.1	36	200
SO2 (μg/m^3)	26.2	21.8	20.9	*21.8*	21.5	21.7	22.5	26.2	350
Noise (db)	65.3	58.2	57.9	*58.5*	58.3	58.4	58.9	65.3	55-70 (QCVN 26/ 2010/BTNMT) 45-55 (WHO Guidelines)

Table 17. Noise level of IFC's EHS guildlines

Receptor	One Hour L_{Aeq}(dBA)	
	Day Time 07:00-22:00	**Nightime 22:00-07:00**
Residential; institutional; educational	**55**	**45**
Industrial; commercial	**70**	**70**

e. Hydrology

161. Ha Giang City is located in a mountainous and forested sub-basin of the Lô River Basin. The sub-basin is approximately 8,300 km^2, while the entire Lo river basin in Viet Nam is 39,000 km^2. The Ha Giang sub-basin includes the Mien River Basin (1,173 km^2) which is the main tributary to the Lô River entering the city from the north. More than 80% of total annual rainfall falls with enough energy to produce soil erosion. As a result sediment transport processes are quite important in the Lô River Basin: average rates of 0.25 mm/year have been registered in the period 1974-2007, according to Le et al. (2010).

f. Water resources

162. The two main rivers in Ha Giang are the Lo and Mien Rivers. The Ha Giang river gauge shows average river level during the dry season to be 96.7 msl, while flood levels considered to occur above a gauge height of 101-104msl. The estimated average flow of the river in the city is 156 m^3/s, with average dry season and wet season flows 105 m^3/s and 1,760 m^3/s. The high river width ranges from 90 m to 220 m with depth ranging from 0.5-2 m (dry season) to 12 m (flood season). The large Malutang dam on the Lo River in the PRC affects the natural flow of the river.

163. The Mien River in northern Ha Giang City has a total length of 58 km which enters the Lô River in Tran Phu Ward. The high river width ranges from 40 m to 85 m with water depth ranging from 0.5-2.5 m in the dry season to 10 m during the wet season. Some landslide problems have been detected in recent years. A system of five hydropower plants will be completed in 2017 on this river. Four are already operating.

164. Me Stream, a smaller downriver tributary of Lô River ranges in width from 15 - 25 m with depth ranging from 0.5-2.5 m in the dry season to 10 m during the wet season. The Chang causeway-spillway is located on the stream which influences flow. Nam Thau stream is a tributary of the Mien river which is 16-23 m wide and 0.5-2m deep. Tien Stream a small

tributary of the Lô River just upstream the of Mien River and Lô River confluence.

g. Floods

165. Flooding in Ha Giang is mainly caused by river overflows from rainfall and expectedly water releases from upstream dams. Flooding is apparently flashy due to the steep river valleys and grades. There are some low spots within the urban area which flood easily. Extraordinary flood waters in the Lô River were recorded in August 1969 (105.57 m), August 1971, July 1972, July 1986, April 1989, May 1990, August 1995, July 2000, and September 2014 (103.46 m). Furthermore, according to Vietnam Institute of Irrigation, discharge of the Lo river during flood events of August 1969 and August 1971 were estimated at 4,010 m^3/s and 5,040 m^3/s, respectively. In recent years the construction of dams in the upper Lô River basin both in Viet Nam and in the PRC have apparently led to a decrease of the number of severe floods in the city despite suspected releases from the upstream dams.

166. Rapid urbanization has resulted in local streams (drains) becoming blocked in places as a result of households dumping solid waste into the streams. The impaired hydraulic capacity of streams results in local flooding in many areas of the city. In certain areas such as Nguyen Trai Ward and the stadium area flooding is chronic. Data on historical floods and their impacts in Ha Giang and the surrounding areas are scarce.

h. Surface water quality

167. Surface water quality was sampled at several sites in the subproject area as part of the national EIA (30 October 2017). Tables 16 and 17 summarize sampling sites and water quality and the 10 sites.

Table 18. Location of surface water samples

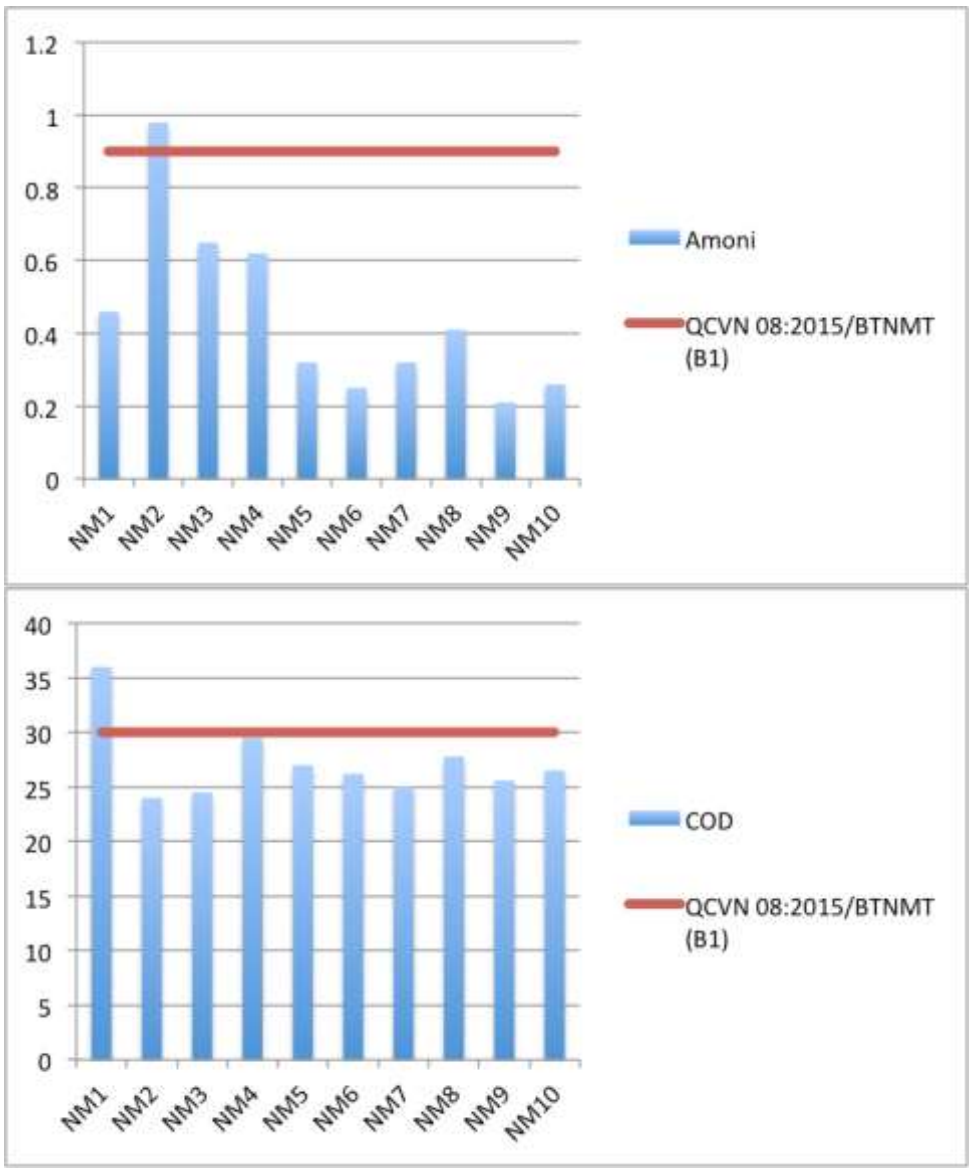
Site Code	Site
NM1	At a discharge gate in residential group 4 of Tran Phu ward to Lo river
NM2	At Chang spillway on Me stream
NM3	At Phong Quang 1 bridge to residential group 9
NM4	At Nam Thau stream
NM5	At Mien River (adjacent to raw water pumping station of Ha Giang water supply company)
NM6	At Lo river within the section proposed to be embanked
NM7	Me stream (close to Le Quy Don secondary school)
NM8	At Yen Bien bridge
NM9	At Mien river bridge
NM10	At Phong Quang 2 bridge to Ha Phuong water park

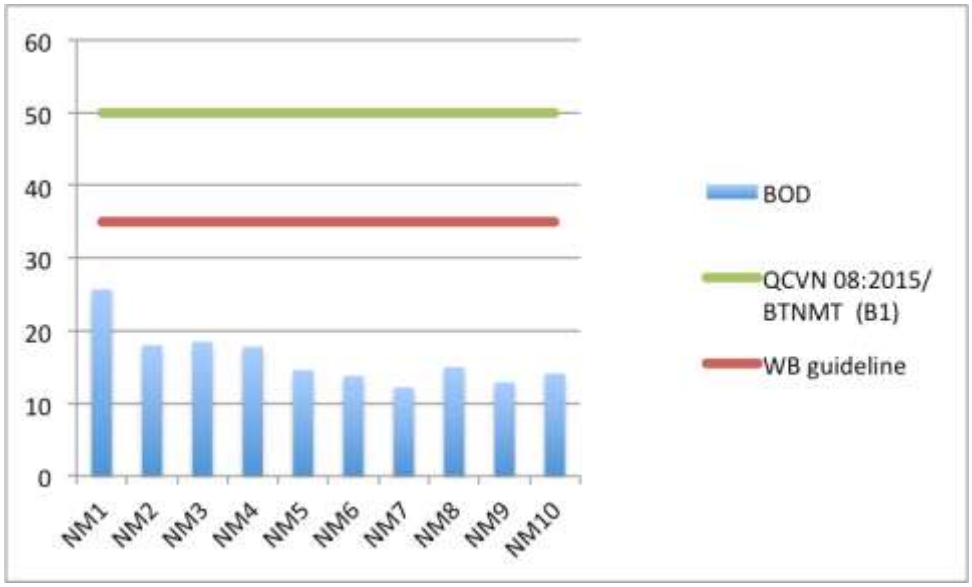
Table 19. Surface water quality

Parameter	Unit	NM1	NM2	NM3	NM4	NM5	NM6	NM7	NM8	NM9	NM10	QCVN 08:2015/BTNMT (B1)
pH	-	7.27	7.02	7.19	7.25	7.18	7.21	7.08	7.12	7.22	7.19	5.5 - 9
TSS	mg/l	15	18.6	22.0	22.6	20.6	21.2	19.6	21.4	18.8	21.0	50
Colifom	MPN/100ml	3800	6500	4180	4100	3850	3210	3300	3960	3150	3200	7500
BOD_5 5 samples exceeded QCVN standard	mg/l	**25.7**	**18.0**	**18.5**	**17.8**	14.6	13.8	12.2	15	12.9	14.1	15
COD 1 sample exceeded QCVN standard	mg/l	**36**	24.0	24.5	29.5	27	26.2	25.0	27.8	25.6	26.5	30
Amonia (NH4+) 1 sample exceede QCVN standard	mg/l	0.46	**0.98**	0.65	0.62	0.32	0.25	0.32	0.41	0.21	0.26	0.9
Grease and oil	mg/l	0.038	0.029	0.024	0.031	0.025	0.028	0.022	0.024	0.020	0.032	1

168. Figure 68 provides indices of water quality in Ha Giang project area in relation to a composite national standard. Figure 67 indicates that the quality of surface water is good with respect to compliance with QCVN water quality standards, but the data also reveal that the surface water sources have started to become polluted as some parameters such as BOD_5 (5 samples), COD (single sample) and ammonia (single sample) in a few locations are higher than the standards.

Figure 68. Summary of surface water quality and QCVN standards





i. Soil quality

169. Soil quality was assessed as part of the IEE to determine whether any excavated material posed an environmental contaminant problem for Ha Giang area. Tables 18 and 19 list the sampling locations and the quality of soil sampled, respectively. The soil of Ha Giang is not considered contaminated as excavated material is reused for leveling lowland areas proposed for commercial and industrial activities. The sediments can however not be used for agricultural, forestry and as topsoil for residential areas given the elevated concentrations of Zn, Cd and Cu that slightly exceed the relevant standard.

.

Table 20. Location of soil sampling stations

Code	Sampling location
D1	On Phung Hung road
D2	On Landfill
D3	Xuan Thuy road (Lùng Càng Hamlet, Hà Giang city)
D4	On the bank of canal T4 of Tran Phu ward near the discharge gate to Lo river
D5	On the bank of Me stream near Chang spill way
D6	At the foot of Phong Quang bridge
D7	On the bank of Nam Thau stream
D8	Sediment of Mien river
D9	On the bank of Lo river
D10	On the bank of Me stream near Le Quy Don school

Table 21. Soil quality of Ha Giang city

Param	Unit	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	QCVN 03:2015/BTNMT				
												Agricultural land	Forestry land	Residential land	Commercial land	Industrial land
As	mg/kg	1.55	6.25	1.38	6.25	1.38	6.25	1.38	1.55	6.25	1.38	15	20	15	20	25
Cd	mg/kg	1.26	**2.87**	**1.61**	**2.87**	**1.61**	**2.87**	**1.61**	1.26	**2.87**	**1.61**	1.5	2	2	5	10
Cu	mg/kg	42.3	90.6	46.7	90.6	46.7	90.6	46.7	42.3	90.6	46.7	100	150	100	200	300
Pb	mg/kg	50.2	88.0	45.0	88.0	45.0	88.0	45.0	50.2	88.0	45.0	70	100	70	200	300
Zn	mg/kg	136	**291**	131	**291**	131	**291**	131		**291**	131	200	200	200	300	300

170. Table 18 shows that aside from cadmium and zinc, soil quality in Ha Giang is good. Eight soil samples contained cadmium and zinc at levels that exceed QCVN standards for these metals in soil (QCVN 03:2015/BTNMT) and also according to the standard, the excavated material cannot be re-used to elevate lowlands that are proposed for agricultural, forestry and residential purposes.

3. Monitoring for Environmental Management Plan

171. A subset of the total sites sampled for the national EIA will be considered for the monitoring program of the Environmental Management Plan (EMP) for the Ha Giang subproject. The subset of sampling sites from the EIA from which potential monitoring sites will be selected for air and water quality monitoring for the EMP are identified in Figure 69 and Table 20.

Figure 69. Subset of sampling sites for EMP

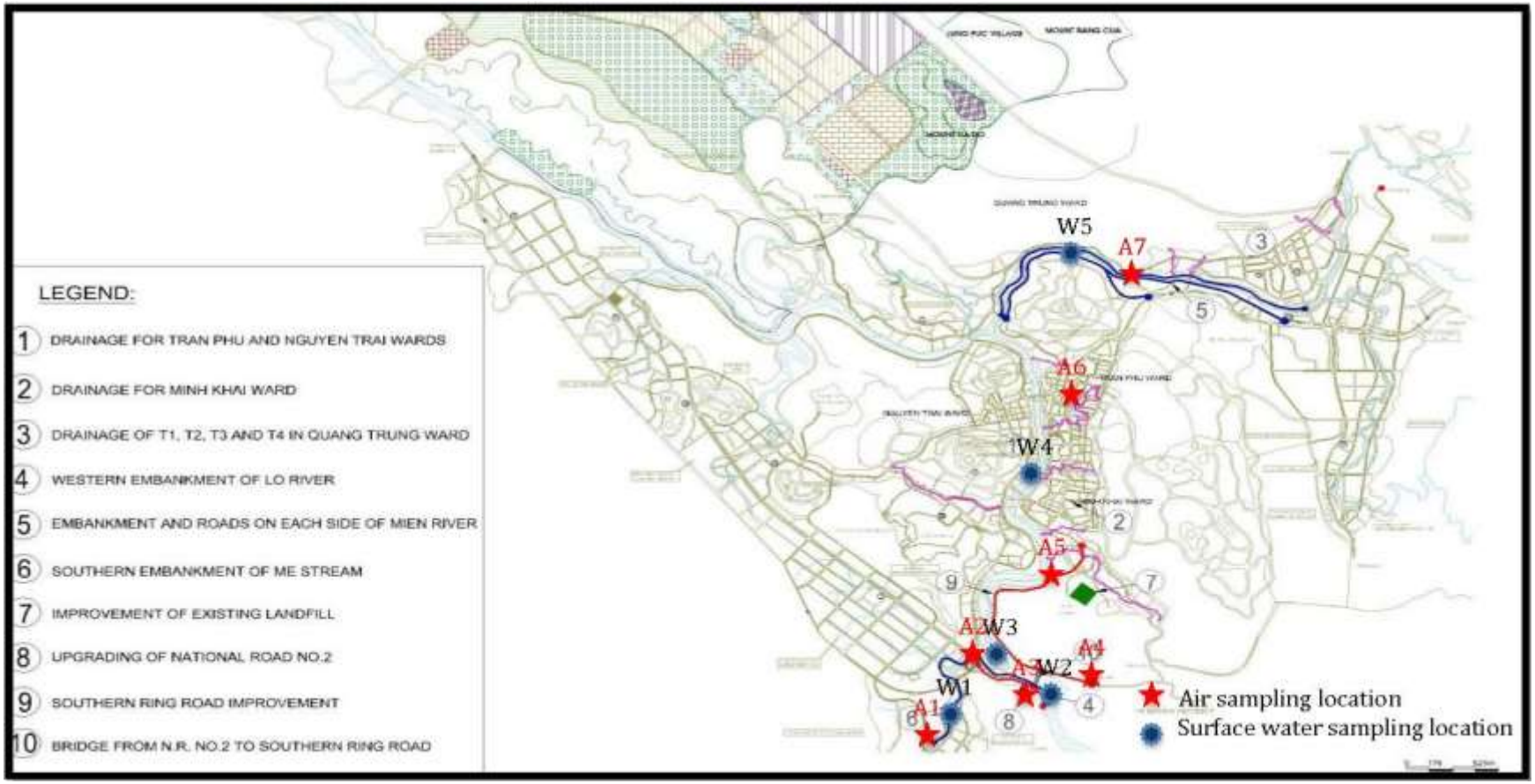


Table 22. Proposed air and water quality monitoring sites for EMP.

Map Code	Location	Parameters	Parameters exceeding QCVN Standard during EIA
Surface water quality			
W1	Me stream	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	BOD_5, NH_4^+,
W2	Lo River at the proposed bridge, component #10	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	None
W3	Lo River at the embankment section, component #4	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	None
W4	Lo River at a discharge gate in residential group 4 of Tran Phu ward to Lo river	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	COD, BOD_5
W5	Mien River at the embankment section, component #5	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	None
Air ambient quality			
A1	Residential area near Chang spillway, component #6	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A2	Residential area along the upgraded section of National Highway 2, component #8	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A3	Residential area, along National Highway 2 and close to the bridge, component #10	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A4	Residential area close to the ring road, component #9	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A5	Residential area close to the ring road, component #9	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A6	Residential area close to components for upgrading drainage system #1,2,3	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A7	Residential area near component #5: embankment an roads on each side of Mien River	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none

4. Ecological Resources

172. There are five nature reserves in Ha Giang province (Bac Me, Bat Dai Son, Du Gia, Phong Quang and Tay Con Linh) in which many endangered and endemic wildlife species are living. These reserves are far from the subproject area with the closest being Du Gia Reserve 30 km from the city.

173. Vegetation in the subproject area includes planted urban trees for shade, homestead fruit trees, production trees defined by eucalyptus, and acacia species. There are a few types of birds and no significant terrestrial wildlife animals in the city are observed within the subproject area for many years.

174. The Lo River and Mien River support fish populations for subsistence fishing in the area. Based on the General Plan for Fishery Development for 2010 with the Vision to 2020 for Ha Giang Province done by Ha Giang DARD, and as confirmed by Ha Giang DARD during the preparation of this IEE, there are no rare or endangered aquatic wildlife in the Ha Giang area waters.

a. Forest management

175. Forests in the province are classified into three categories defined by “Protected Forests”, “Special Use Forests”, and “Production Forests”. In Ha Giang city, and throughout the subproject area only some production forests exist. For example, production forest exists along the proposed alignment for the Ring Road adjacent to the Lo River. About 2.4 ha of production forest will be acquisitioned for two components (Southern Ring Road and Bridge to connect NH2 to Southern Ring Road). This will be compensated through the REMDP for the project.

5. Socioeconomic Profile

a. Cultural Resources

176. Within the subproject area there is only the Nam Dau Pagoda which has been recognized as a national monument since 2009. This pagoda is located in Ngoc Linh commune, Vi Xuyen District and about 5km away from the southern ring road component.

177. Many villages in Ha Giang City display the distinct culture of their ethnic origin through language, songs, clothes, lifestyle, housing, and food. Tha, Ha Thanh cultural villages located in Phuong Do commune which became part of Ha Giang City in 2007 is 2 - 6 km from National Highway #2. Cultural events in Ha Giang City include Long Tong Festival by the Tay ethnic group and Mother Temple Festival in February and Street Festival in August. The city has horse, hawk, and buffalo fights during cultural events. The festivals and ethnic villages are examples of the rich cultural, social, and ethnic traditions of the city. Ethnic diversity is a strength of Ha Giang City.

b. Land Use

178. Ha Giang province has 788,437 ha of natural land. The land base is divided among agriculture - 134,184 ha at 17%, forests - 334,101 ha at 42.37%; land for special purposes - 5,676 ha, at 0.71%; residential land - 4,412 ha at 0.55%; unused land and rivers - 310,064 ha at 39.32%; water surface area of 612 ha at 0.45%. Of agricultural land, annual tree area is 110,023 ha, rice for two seasons occupies 22.26%, and perennial tree culture uses 16,817 ha, accounting for 12.53%. The land occupied by the subproject is primarily agriculture land and production forestry land.

179. The Lo and Mien Rivers, and Me Stream are used currently for drainage and flood management and also provide irrigation water and there are small fishing and aquaculture activities.

c. Water Supply and Sanitation

180. The water supply network in the urban communes reaches almost 100% coverage. Water supply in the three rural communes in the city was between 96.4% and 99.5% in 2014. The people within the project area do not use underground water or water from local springs for dringking. Most households in the urban areas of Ha Giang City have sanitary toilets. Only about 67% of the households in the rural communes of the city has access to sanitary toilets. In the urban wards, use of septic tanks is most common for the disposal and treatment of waste water.

d. Sewerage and Drainage Network

181. The city has a combined wastewater and storm water drainage system which flows into tributaries and the Lo River and Mien River. Encroachment and indiscriminate waste dumping has resulted to narrowing of streams, reducing flow capacity, and increasing flood occurrences. There is no wastewater collection system in place and waste water is currently discharged in rivers and streams. A project for wastewater collection and treatment system is currently being prepared by the Danish International Development Agency (DANIDA).

e. Population and demographic

182. Ha Giang City has a total population of 52,135 inhabitants (2013). The economy is predominantly agricultural, and has the country's lowest average income. The incidence of poverty is about 37%, and access to some basic services, particularly sanitation facilities, remains poor.

183. The city has 22 identified ethnic groups thriving, and is one among the cities in Viet Nam where a high percentage of the population is ethnic groups. Ha Giang City has a majority of Kinh ethnic people representing roughly 59% of the population followed by Tay (27%), Dao (6%), and Hoa/Han (3%). Other known ethnic minorities are Nung, Mong, and Giay groups who are constantly growing over the past years.

184. The population has been growing constantly by 4% each year from 2011 to 2013. The population density stands at 392 people per square kilometer representing a slight increase of nearly 4% from 2011 to 2013. The urban Wards within Ha Giang City account for 76% of the population. The current ratio between in-migration to out-migration is higher than 2:1, with women representing the larger group for both movements.

f. Economic and labor structures

185. Ha Giang City is the economic center of the province, hosting 13 out 14 state enterprises, more than 500 non-state enterprises, and foreign investment enterprises. In the small-scale manufacturing, private and household enterprises are concentrated on rattan and wooden furniture, weaving and embroidery of ethnic clothing, as well as aluminum production. In the private sector, enterprises in construction, industry, and trade have the highest number of wage laborers in Ha Giang City. However, taking into account also non-agricultural, individual business establishments, the number of employees is highest in wholesale and retail trade (including vehicle repair services), accommodation and catering services, and manufacturing and processing. In the agricultural sector, which is dominating in the rural communes, employment has been primarily concentrated in farming. (Table 21).

Table 23. Socioeconomic profile of Ha Giang City, 2014

	Unit	2011	2012	2013
Land area	Km2	134.04		
Average population		50,070	51,180	52,135
Density	Head/km^2	378	386	392
Population growth	%	13.17	13.05	12.93
Annual new jobs		1,500	1,600	1,625
Economic structure				
a) agriculture, forestry and aquaculture	%	5.44	5.34	5.11
b) Industry and construction	%	24.12	23.90	24.17
c) service	%	70.44	70.76	70.72

Source: Ha Giang Socioeconomic Profile, 2014.

C. Vinh Yen City

1. Overview

186. Vinh Yen city is the capital of Vinh Phuc Province. The city is formed by the seven administrative units of Ngo Quyen, Lien Bao, Tich Son, Dong Tam, Khai Quang, Dong Da and, and two communes of Dinh Trung and Thanh Tru. The total area is 51 km^2 with a population of 101,644. Vinh Yen city was formerly a town - Urban grade IV along with the general development trend of the urban system of the whole country In December 2004 Vinh Yen town was promulgated by the Minister of Construction as a Grade III city, and on October 23, 2014, the Decision 1909 / QD-TTg was issued recognizing Vinh Yen as Urban type II belonging to Vinh Phuc province.

187. Vinh Yen city is located 60 km northwest of Ha Noi and 23 km southeast of Viet Tri City. Vinh Yen city borders Kim Long commune, Tam Duong district in the sorth, Dong Cuong commune, Yen Lac district in the south, Thanh Van commune, Van Hoi commune and Hop Thinh commune, Tam Duong district in the west, and Huong Son, Quat Luu communes of Binh Xuyen district in the east.

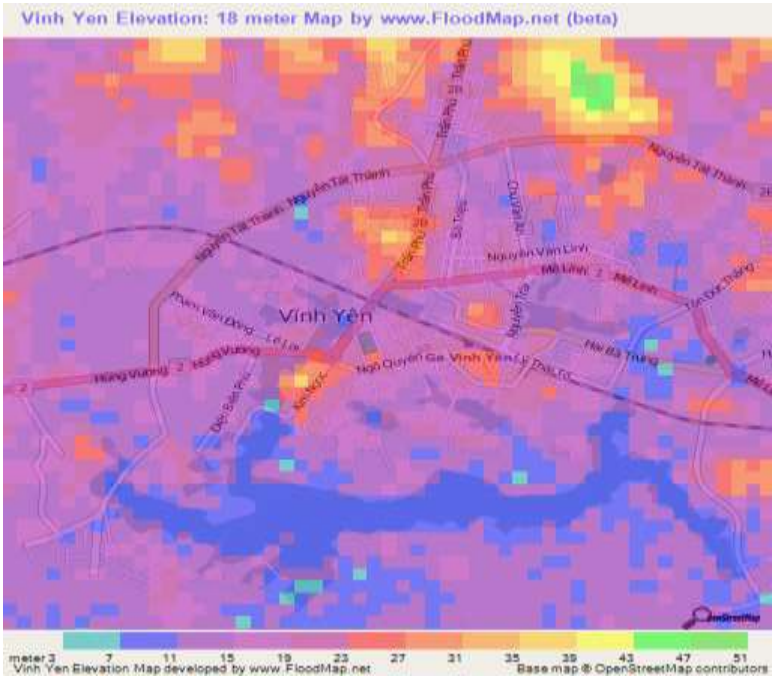
2. Physical Resources

a. Topography

188. Vinh Yen is located in the transitional area between the mountains and the river delta. The variable topography includes low hills and flat plains dotted with ponds and lakes. Dam Vac Lake is a beautiful 160ha lake located in the heart of the city. The lake is a valuable natural asset with great potential for tourist and cultural development. Dam Vac Lake is Vinh Yen's unique local attraction.

189. The high elevation of Vinh Yen city is between 6m to 30msl. The hills are not continuous and are separated by valleys, extending to south and narrowing to north. The north has low hills ranging from 9m to 30msl rising to the northeast towards Tam Dao. In the south and southwest Dam Vac is connected with lowland fields with elevation ranging from 6m to 8msl, which is chronically flooded during the rainy season (Figure 70).

Figure 70. Elevations of Vinh Yen city



b. Climate

190. The subproject area experiences a tropical monsoon climate with two distinctive seasons defined by the rainy and dry seasons. The rainy season extends from May to October while the dry season lasts from October until the end of April.

191. Data from the Vinh Yen meteorological station show average annual temperature of 23.^{0}C, with the recorded highest temperature of 41.^{o}C (in May) and the lowest at 2.2^{0}C (in December). Annual average temperature has ranged from 21.6 ° C - 23.9 ° C. In hot weather the absolute high temperatures exceeds 40^{o}C. Conversely, the absolute low temperature has been 3.7^o C (January).

192. Rainfall in the project area is unevenly distributed in space and time. Rainfall mainly concentrates from June to September (accounting for 75% to 85% of the annual rainfall). In spatial terms, rainfall is usually higher in the mountains than in the plains and midlands. The average annual rainfall at the Vinh Yen station, which represents the plains and midlands, is 1,574.8 mm. The heaviest rains occur in August which usually last in 2-3 days with a large proportion of rain falling on the second day of the event. The intensity of rainstorms is high which can reach 86 mm/hour at Vinh Yen station. The number of rainy days with intensity of 50-100 mm is about 6-18 days per year on average; and the number of rainy days with intensity of more than 100 mm is 2-5 days per year, mostly occurring in July and August (accounting for 50% of the number of rainy days with the same intensity in the whole year).

193. The average humidity over the years in Vinh Yen city is 81.7%. Annually there are two monsoon seasons defined the northeast monsoon and southeast monsoon. The northeast monsoon prevails from October to March of the following year and often accompanied with hoarfrost, which affects agricultural production. The southeast wind lasts from April to September carrying fog and causing heavy showers. The average wind speed in the plain area of Vinh Yen is 1.6 m/s

c. Seismicity

194. Based on the zoning map for maximum credible earthquakes in Vietnam above, Vinh Yen City is located in the zone with index II.1. In the last 10 years, no earthquake occured in Ha Giang City. Some earthquakes occurred in Dong Van District 150 km away with the maximum magnitude of 4.5 on the Richter scale.

d. Air quality, Noise

195. Air quality in the Vinh Yen area was measured as part of the national EIA of the subproject (5 days in February 2016). A description of sampling sites is provided in Table 22. Air quality and noise levels sampled was analyzed and compared to national ambient air quality standards (QCVN 05-2013) and the national standard for noise (QCVN 26-2010) as well as WHO ambient air quality and noise guidelines (Table 23).

Table 24. Location of air quality sampling sites in Vinh Yen

I	Sampling locaiton	Code	Coordinates VN2000	
			X	Y
1	At the begining of the proposed road	KK1	559575,78	2359717,11
2	At the end of the proposed road	KK2	562561,81	2361261,02
3	Trang Bridge close to the gate of Red River Capital Hotel	KK3	560,096.83	2,356,197.73
4	Close to Vac Lake at the spill way	KK4	561,247.15	2,355,204.83
5	Close to Protection Zone E of Lac lake	KK5	562,573.91	2,354,054.14
6	Close to Protection Zone B of Lac lake	KK6	561,714.13	2,355,578.57
7	The location for proposed WWTP	KK7	558803,99	2354318,11
8	Close to Ngo Quyen People Committee Ward Office	KK8	561639,81	2357139,20
9	In Dong Da Ward	KK9	562077,47	2356678,60
10	Crossroad T50, Tich Son Ward	KK10	560333,95	2357100,72
11	At the gate of Dong Tam People Committee Ward office	KK11	558443,66	2357095,34
12	At the crossroad close to Hoi Hop People Committee Ward office	KK12	557597,71	2355731,74

196. Table 22 indicates that air quality in Vinh Yen when the EIA was conducted was good. No sample exceeded national standards. Concentrations of air pollutants associated with combustion of fossil fuels such NO_2, CO and SO_2 are very low and several times less than the permitted standards. The moderate noise level did not exceed permissible limits.

Table 25. Ambient air quality in Vinh Yen City

Parameters	**KK1**	**KK2**	**KK3**	**KK4**	**KK5**	**KK6**	**QCVN05/ 2013/ BTNMT**	**QCVN 26/ 2010/ BTNMT**
TSP (μg/m3)	47	133	51	*21*	31	35	**300**	-
CO (μg/m3)	5200	6500	5500	*5700*	4800	5700	**30000**	-
NO2 (μg/m3)	42	76	44	*45*	32	42	**200**	-
SO2 (μg/m3)	36	83	38	*42*	26	41	**350**	-
Noise (dB(A))	58	65	63	*57.7*	49	55		Day time: 70 Night time: 55
Parameters	**KK7**	**KK8**	**KK9**	**KK10**	**KK11**	**KK12**	**QCVN05/ 2013/ BTNMT**	**QCVN 26/ 2010/ BTNMT**
TSP (μg/m3)	76	96	59	*178*	77	102	**300**	-
CO (μg/m3)	4100	5700	5600	*6200*	5500	5200	**30000**	-
NO2 (μg/m3)	49	63	35	*52*	50	78	**200**	-
SO2 (μg/m3)	76	42	55	*88*	93	67	**350**	-
Noise - day time (dB(A))	65	64	61	*69*	63	60		Day time: 70 Night time: 55

e. Hydrology & water resources

197. The city of Vinh Yen is located in the Phan-Cà Lô River Basin; and of 1.229 km^2, which drains into the larger Cau River. The sub-basin affecting the city of Vinh Yen has an estimated area of 111 km^2. The combination of flat topography and a dense hydrology network strongly influences downstream conditions. The water level in the main rivers affects upstream river reaches causing severe drainage problems, reverse flows and flooding. At present several areas south and southeast of the city are prone to flooding. This poses serious challenges to flood management. Being part of the lower Phan-Cà Lô River Basin the most relevant waterbodies of Vinh Yen are described below.

- Phan River, which drains an area of 348 km^2 of the 1,229 km^2 of the entire Phan-Cà Lô River Basin, surrounds the city in the west and the south. Dam Vac lake drains into Phan River and joins Ca Lo River 19 km downstream of Vinh Yen.
- Dam Vac Lake is a 160 ha non-stagnant water body located in the southern part of the city. The lake is mainly fed by the Ben Tre Canal in the northwest and by the Khai Quang stream in the northeast through the Khai Quang Lake. The Dam Vac Lake has a non-regulated outlet to the Phan River.
- Ben Tre Canal, a 12 km main irrigation channel draining to Dam Vac Lake.
- Khai Quang stream flows from Khai Quang lake in the northeast into Dam Vac Lake.

- Cau Ton River, Tran Dong River and Ba Hanh River are three watercourses draining the Tam Dao Mountains. They are interconnected and flow through two branches, both to the Phan river and to the Cà Lô river after intersecting the Phan River on the right bank.
- Cà Lô River drains an area of 881 km^2 with several streams rising in Tao Dao and Soc Son mountains. The Cà Lô River flows 86 km to the east until it meets the Cau River.

198. In addition to Dam Vac, there are the following ponds in the city:
- Chua pond and Vay pond, Ngo Quyen Ward,
- Bo Rem pond and Ba Lang pond, Dong Da Ward,
- Cong Tinh pond, Bo Phat ponds, Canh Nong pond and Cau Phao pond, Tich Son Ward,
- Bao Quang pond, Khai Quang Ward.

199. These ponds combine with Dam Vac and Phan River to form a system of ponds and lakes, which are particularly important for the storage of water for regulating, draining and treating wastewater, as well as air conditioning (microclimate) for the area. However, due to the intensive urbanization processes in the locality, the expansion of National Highway 2, the spontaneous construction process, the expansion and illegal encroachment by people, the area of the water surface in the area is trending to be narrowed.

f. Floods and damages

200. The flooding history from 1990-2014 in the subproject is described as follows: Phan - Ca Lo River basin was flooded in 20 out of 25 years with 1 to 3 times of waterlogging per year. When heavy rain falls the Phan River rises, impeding the drainage from the areas. The highwater level in Phan River often lasts for several days. At Sau V, the flood level of over 8.0m during November 2009 last for 15 days from November 2 to November 17. A flood in August 2013 last for 12 days, in July 2007 last for 10 days, and in August 2006 a flood last for 8 days. The flooding level in some areas is from 1.8m to 2.5m, inundation in these areas often lasts from 10 to 20 days.

201. The Dam Vac Lake overflows when the water level reaches 8.5-9 msl. In the last 45 years, the lake's water level has exceeded 8.5 m six times, and 9 m four times. Vinh Yen City and neighboring area have about 180ha of frequently-flooded area. Particularly, several residential areas in the city center are usually flooded from 0.2m to 0.5m in heavy rains. Some suburban residential areas including Dam Coi, Quan Tien, Vinh Quang (Thanh Tru), and Lac Y (Dong Tam) are isolated when the flood water in Phan River is high.

g. Surface water quality

202. Surface water quality was determined at several sites in the subproject project area as part of the national EIA (5 days in February 2016). Sample codes and location are shown in Table 24, and Table 25 summarizes the water quality at the 18 sites sampled.

Table 26. Location of surface water samples

No	Code	Location
1	NM1	Vac Lake in protection zone E
2	NM2	Vac Lake in protection zone B
3	NM3	Vac Lake at Trang bridge
4	NM4	Vac lake close to the gate of Dao Ngoc hotel
5	NM5	At a Pond near Tien Son pagoda
6	NM6	At a Pond in Dong Cuong hamlet, Dong Tam ward
7	NM7	At a Pond near Lam Son cultural house
8	NM8	At Coi Lake
9	NM9	At a irrigation crossing the access road to new WWTP
10	NM10	At a Pond of local household close to the access road (sample 1)
11	NM11	At a Pond of local household close to the access road (sample 2)
12	NM12	At a Lap lake
13	NM13	At the pond in front of the gate of PPC building
14	NM14	At Phan river under Mui bridge
15	NM15	At Phan river 250 m downstream Mui bridge
16	NM16	At a Pond in the middle of the proposed road
17	NM17	At the begining of Ben Tre cannal
18	NM18	At a Pond in the beginning of the proposed road

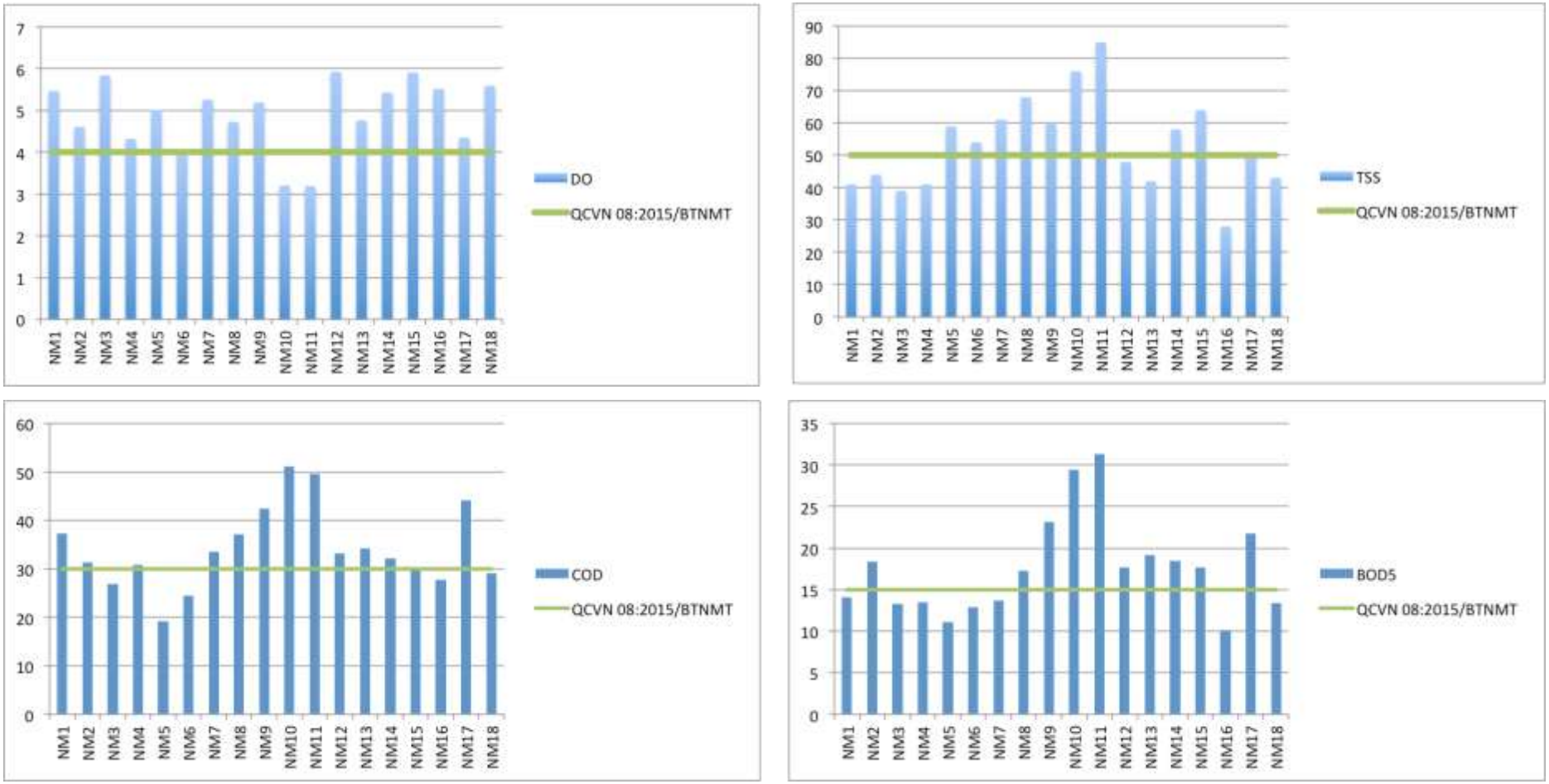
203. Figure 71 provides indices of water quality (parameter value/standard) in Vinh Yen project area in relation to the composite national standard. Figure 71 indicates that the surface water quality at most of stations started being polluted. More than half of total stations have COD, BOD, TSS concentrations and Coliform counts in excess of the permitted standards. Two stations have DO concentrations lower than the standard and the same number of stations have NH_4^+ higher than the standard. The sampling result revealed the pollution of water surface sources in the subproject area that is understood to be caused by domestic wastewater of surrouding residential areas being discharged without treatment to surface water bodies.

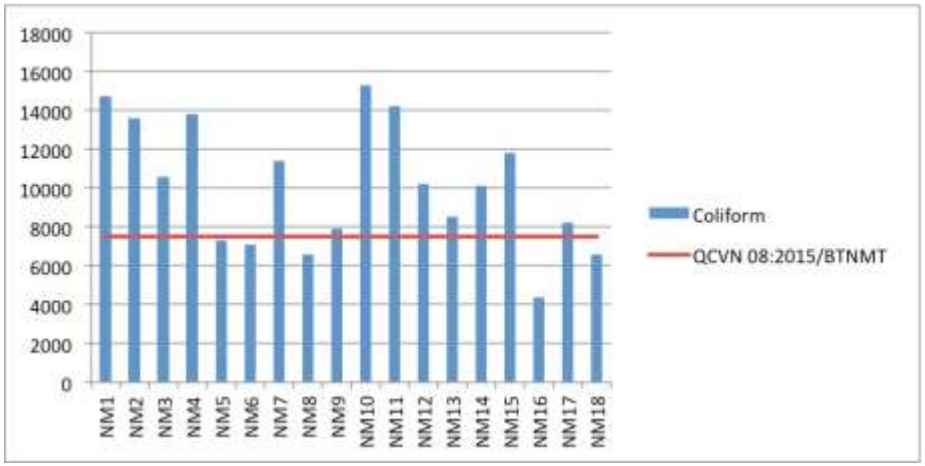
Table 27. Surface water quality in Vin Yen area

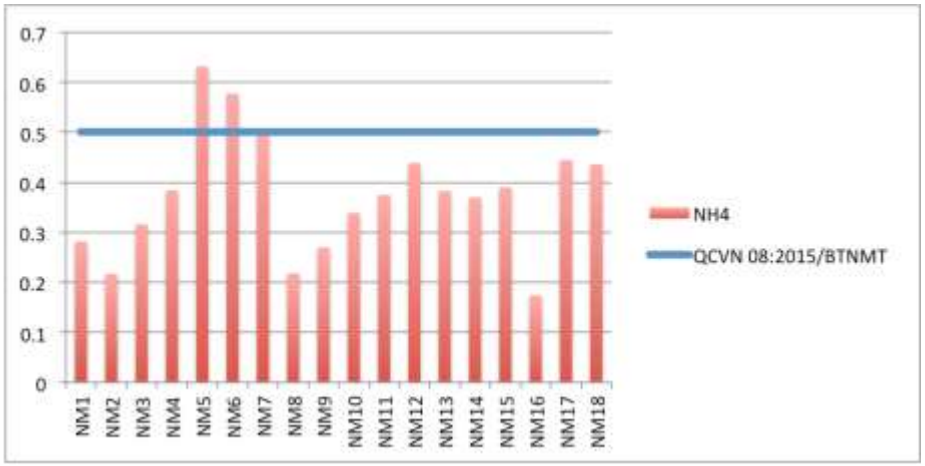
Parameters	Unit	NM1	NM2	NM3	NM4	NM5	NM6	NM7	NM8	NM9	NM10	QCVN 08:2015/ BTNMT (B1)
pH	-	6.2	6.4	6.3	6.1	5.9	6.2	6.3	6.9	5.7	6	**5.5-9**
TSS (10/18 samples exceeding the standard)	mg/l	41	44	39	41	**59**	**54**	**61**	**68**	**60**	**76**	**50**
DO (2/18 samples lower than the standard)	mg/l	5.47	4.61	5.84	4.32	5.01	4.06	5.26	4.73	5.19	**3.2**	**4**
BOD_5 (10/18 samples exceeding the standard)	mg/l	14.05	**18.33**	13.26	13.45	11.09	12.9	13.72	**17.3**	**23.16**	**29.43**	**15**
COD (12/18 samples exceeding the standard)	mg/l	**37.23**	**31.29**	26.93	**30.89**	19.2	24.5	**33.57**	**37.12**	**42.39**	**51.18**	**30**
NH_4 (2/18 samples exceeding the standard)	mg/l	0.282	0.217	0.316	0.384	**0.632**	**0.578**	0.497	0.218	0.27	0.339	**0.5**
NO_3	mg/l	0.392	0.41	0.446	0.391	0.227	0.316	0.533	0.393	0.261	0.477	**0.9**
Oil and grease	mg/l	0.01	0.03	0.08	0.12	0.07	0.16	0.11	0.02	0.05	0.09	**1**
Coliform	MPN/ 100ml	**14,700**	**13,600**	**10,600**	**13,800**	7,300	7,100	11,400	6,600	**7,900**	**15,300**	**7,500**

Parameters	**unit**	**NM11**	**NM12**	**NM13**	**NM14**	**NM15**	**NM16**	**NM17**	**NM18**	**QCVN 08:2015/BTNMT (B1)**
pH	-	5.8	6.3	6.7	6.9	6.6	6.8	6.3	6.7	**5.5-9**
TSS (10/18 samples exceeding the standard)	mg/l	**85**	48	42	**58**	**64**	28	**51**	43	**50**
DO (2/18 samples lower than the standard)	mg/l	**3.19**	5.93	4.76	5.43	5.91	5.52	4.35	5.59	**4**
BOD_5 (10/18 samples exceeding the standard)	mg/l	**31.28**	**17.63**	**19.18**	**18.49**	**17.63**	10.08	**21.79**	13.41	**15**
COD (12/18 samples exceeding the standard)	mg/l	**49.64**	**33.28**	**34.18**	**32.18**	29.77	27.74	**44.09**	29.13	**30**
NH_4 (02/18 samples exceeding the standard)	mg/l	0.375	0.439	0.383	0.37	0.39	0.174	0.445	0.436	**0.5**
NO_3	mg/l	0.519	0.736	0.713	0.37	0.38	0.149	0.581	0.366	**0.9**
Oil and grease	mg/l	0.13	0.06	0.07	0.09	0.06	0.02	0.01	0.06	**1**
Coliform (12/18 samples exceeding the standard)	MPN/100ml	**14,200**	**10,200**	**8,500**	**10,100**	**11,800**	4,400	**8,200**	6,600	**7,500**

Figure 71. Summary of surface water quality and QCVN standards




18000
16000
14000
12000
10000
8000
6000
4000
2000
0
NM1
NM2
NM3
NM4
NM5
NM6
NM7
NM8
NM9
NM10
NM11
NM12
NM13
NM14
NM15
NM16
NM17
NM18
Coliform
QCVN 08:2015/BTNMT


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
NM1
NM2
NM3
NM4
NM5
NM6
NM7
NM8
NM9
NM10
NM11
NM12
NM13
NM14
NM15
NM16
NM17
NM18
NH4
QCVN 08:2015/BTNMT

h. Soil and sediment quality

204. Soil and sediment quality was assessed as part of the IEE to determine whether the quality of excavated material posed an environmental contaminant problem for Vinh Yen area. Table 26 and Table 27 list the sampling locations and quality of soil sampled, respectively.

Table 28. Location of soil sampling stations

Code	Location	Coordinates VN2000	
		X	Y
Đ1	Soil close to the protection zone E of Vac Lake	561,563.75	2,355,672.19
Đ2	Soil close to Dao Ngoc hotel	562,266.74	2,356,328.57
D3	Soil at the location of the new WWTP	558602,95	2354328,35
D4	Soil at the location of the new WWTP, close to a local household	558785,70	2354337,38
D5	Soil at the bank of Vac lake close to PPC office	562649,42	2357608,87
D6	Soil at the end of the proposed road	562441,98	2361285,17
D7	Soil at the beginning of the proposed road	559620,91	2359747,96
Code	**Location**	**Coordinates VN2000**	
		X	**Y**
TT1	Sediment of Vac Lake in the protection zone E.	560.751,49	2.355.691,89
TT2	Sediment of Vac Lake in the protection zone B.	561.456,91	2.355.650,78
TT3	Sediment of Vac Lake in the protection zone C.	560.130,92	2.356.180,70
TT4	Sediment of Vac Lake in the protection zone B.	562.192,34	2.356.244,93
TT5	Sediment of the pond close Tien Son pagoda	558172,00	2356254,79
TT6	Sediment of the pond in Dong Cuong hamlet, Dong Tam ward	558791,55	2357691,03
TT7	Sediment of Coi lake	559313,51	2354646,43
TT8	Sediment of the Pond No1 within the location for the WWTP	558988,24	2354423,08
TT9	Sediment of the Pond No2 within the location for the WWTP	558882,31	2354551,50
TT10	Sediment of Phan river at Mui Bridge	562596,62	2354083,95
TT11	Sediment of Phan river 250 Mui bridge downstream	562369,00	2354574,55

TT12	Sediment of Vac Lake close to the proposed green park	561858,16	2355320,38
TT13	Sediment of Phan river close to the beginning of the proposed road	565694,12	2354253,45

205. The soil and bottom sediment quality of Vinh Yen city, and Dam Vac lake, respectively is not considered contaminated as the soil and sediment are able to be reused for leveling lowland areas proposed for commercial and industrial activities. However, the material is suitable to be used for agricultural, forestry land or as top soil for residential areas given the concentrations of Cd and Zn which slightly exceed the relevant standard. The bottom sediment from Dam Vac lake can be used for local infilling projects such as the proposed new Green Park (Tables 27 and 28).

Table 29. Soil quality of Vinh Yen city

Parameters	Unit	D1	D2	D3	D4	D5	D6	D7	QCVN 03-MT:2015/BTNMT		QCVN 04:2008/BTNMT
									Agricultural land	Residential land	Commercial land
Cd	mg/kg	0.022	0.017	0.443	0.375	0.142	0.09	0.11	**1.5**	**2.0**	**-**
As	mg/kg	3.726	4.180	4.502	4.719	2.181	1.31	2.93	**15.0**	**15.0**	**-**
Zn	mg/kg	46.75	70.22	109.87	93.21	65.19	58.60	63.49	**200.0**	**200.0**	**-**
Cr	mg/kg	0.212	0.452	1.36	1.282	0.603	1.10	0.57	**150.0**	**200.0**	**-**
Pb	mg/kg	15.202	27.196	47.318	53.105	36.73	9.05	23.16	**70.0**	**70.0**	**-**
Cu	mg/kg	29.760	40.013	72.656	57.832	33.175	44.04	41.92	**100.0**	**100.0**	**-**
DDT	mg/kg	n/a	n/a	n/a	0.001	n/a	n/a	n/a	**-**	**-**	**0.01**
DDD	mg/kg	n/a	n/a	n/a	0.002	n/a	n/a	n/a	**-**	**-**	**0.01**

Table 30. Sediment quality of Vinh Yen city

Parameters	Unit	Sampling result							QCVN 43:2012/ BTNM	QCVN 03-MT:2015/ BTNM	QCCVN 07: 2009/ BTNM
		TT1	TT2	TT3	TT4	TT5	TT6	TT7			
Cd	mg/kg	0.933	1.475	1.239	1.098	1.833	0.592	0.97	3.5	1.5	10
As	mg/kg	1.140	0.823	1.216	1.139	2.102	1.225	3.711	17.0	15	40
Zn	mg/kg	126.7	209.5	184.6	146.6	173.5	212.6	170.2	315	200	5000
Cr	mg/kg	2.63	5.17	1.93	4.15	1.22	1.68	2.14	90.00	150	100
Hg	mg/kg	0.017	0.104	0.022	0.933	0.141	0.32	0.216	0.5	-	4
Pb	mg/kg	16.30	27.14	21.14	36.70	40.08	34.15	29.18	91.30	70	300
Cu	mg/kg	102.65	74.55	68.17	93.70	46.138	133.18	72.75	197.0	100	-
Parameters	**Unit**	**Sampling result**							**QCVN 43:2012/ BTNM**	**QCVN 03-MT:2015/ BTNM**	**QCCVN 07: 2009/ BTNM**
		TT8	**TT9**	**TT10**	**TT11**	**TT12**	**TT13**				
Cd	mg/kg	1.612	1.084	0.943	1.036	0.725	0.318		3.5	1.5	10
As	mg/kg	2.194	1.017	2.151	2.233	2.097	1.012		17.0	15	40
Zn	mg/kg	184.5	132.1	219.2	178.3	144.5	42.8		315	200	5000
Cr	mg/kg	3.79	4.13	0.94	1.02	2.11	4.02		90.00	150	100
Hg	mg/kg	0.339	0.271	0.135	0.099	0.146	0.002		0.5	-	4
Pb	mg/kg	54.7	61.37	42.18	42.09	36.17	44.48		91.30	70	300
Cu	mg/kg	81.16	113.65	83.16	78.19	44.82	41.018		197.0	100	-

- *QCVN 43:2012/BTNMT - National Technical Regulation on Sediment Quality*
- *QCVN 03-MT:2015/BTNMT National technical regulation on the allowable limits of heavy metals in the soils applying for agricultural land*
- *QCCVN 07: 2009/BTNMT: National Technical Regulation on Hazardous Waste Thresholds*

3. Monitoring for Environmental Management Plan

206. A smaller subset of the sampling sites of the national EIA will be considered for the monitoring program of the Environmental Management Plan (EMP) for the Vinh Yen subproject. The subset of sampling sites from the national EIA from which potential monitoring sites will be selected for air and water quality during implementation of the subproject are identified in Figure 72 and Table 29.

Figure 72. Surface water and air quality monitoring stations for EMP

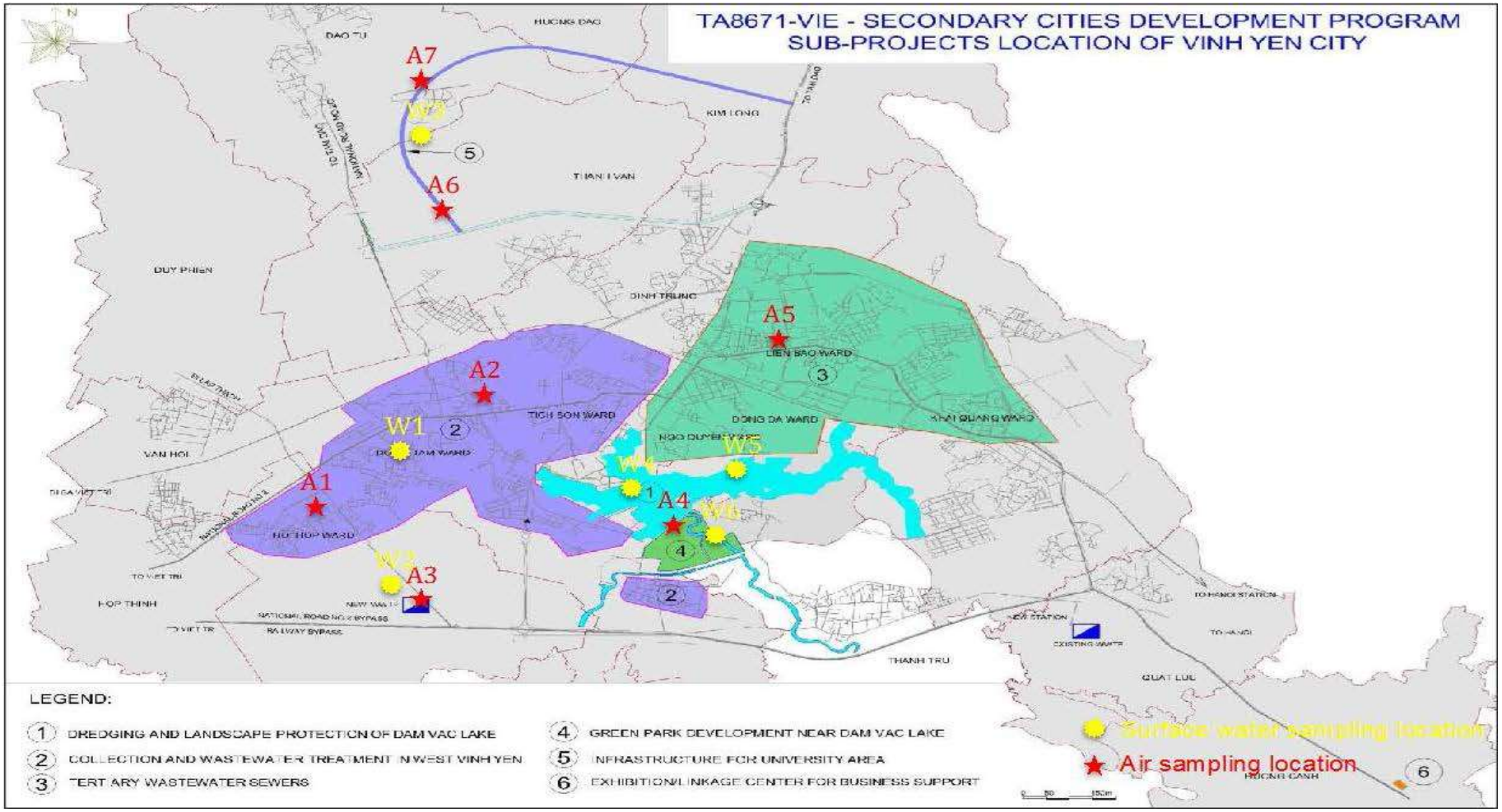


Table 31. Air, noise and water quality monitoring sites for EMP

Map Code	Location	Parameters	Parameters exceeding QCVN Standard during EIA
Surface water quality			
W1	At a water source close to (10 – 20 m) construction works within 3 wards Hoi Hop, Dong Tam and Tich Son	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	TSS, BOD_5, COD, NH_4^+, Coliform
W2	At an irrigation canal of the rice field next to the construction area of new WWTP	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	TSS, BOD_5, COD, Coliform
W3	At a water source close to (10 – 20 m) the proposed new road	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	TSS, BOD_5, COD, Coliform
W4	Vac Lake, close to (5 - 10) dredging activity	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	BOD_5, COD, Coliform
W5	Vac Lake, 30 – 50 m way dredging activity	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	BOD_5, COD, Coliform
W6	At the canal crossing through the proposed area for the green park component and drains water from Thanh Tru commune to Vac Lake	pH, DO, TSS, COD, BOD_5, NH_4^+, Oil and grease (OG), Coliform	None
Air, noise and vibration monitoring			
A1	At a residential area close to (10-15 m) construction activity, component #2	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A2	At a residential area close to (10-15 m) construction activity, component #2	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A3	At a rice field close to the construction site of new WWTP	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A4	At the area proposed for the green park during construction phase	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A5	At a residential area close to (10-15 m) construction activity, component #3	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none

A6	At a residential area close to components of building the new road of univerisity area (sample No.1)	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none
A7	At a residential area close to components of building the new road of univerisity area (sample No.2)	TSP, PM_{10}, CO, SO_2, NO_2, Noise and Vibration	none

4. Ecological Resources

207. According to the Report on “Survey on the current status of biodiversity and biodiversity action plan to 2015 with orientation to 2020 of Vinh Phuc Province”, Vinh Phuc Province has several rare species. However, the designated areas for biodiversity conservation in Vinh Phuc are only limited within Tam Dao National Park and this Park is 20 km far from Vinh Yen City.

208. The terrestrial ecosystem consists of the agricultural ecosystem, rural residential area, and small-and-medium urban area ecosystem. These types of ecosystems are artificial, composed of different common species without dominant species. The number of compositions of species is always subject to changes according to use purposes and economic conditions of the people.

209. The lakes and ponds within the subproject area are primarily used for aquaculture. The water quality in these water bodies, in general, is quite stable compared to other water bodies. The aquatic species in these lakes, swamps and ponds are also considered poor, mainly farmed aquatic species.

210. With regards to freshwater aquatic flora the recognized aquatic communities comprise submerged and floating plants in the rivers and lakes, particularly water hyacinth (Eichhornia crassipes), pistia (Pistia stratiotes), giant water fern (Salvinia cuculata), Salvinia natans, lotus (Nelumbo nucifera), water-lily (Nymphaea pubescens), water primrose (Ludwigia hyssopifolia), Ludwigia adnascens, Utricuaria aurea,and common hornwort (Hydrilla verticilata), etc. In hilly areas, there are some perennial trees such as plant association of Camellia sinensis. The communities of annual terrestrial crops include maize (Zeamays), sweet potato (Ipomoea bataas), potato (Solanum tuberosum), cassava (Manihot esculenta), and other short-term rain-fed crops and the wetrice association (Oryza sativa). The plants surrounding residential areas include Bead-tree Melia azedarach, Orange Citrus sinensis, Lime Citrus aurantium, Longan Dimocarpus longan, Papaya Carica papaya, Banana Musa paradisiaca, etc. Secondary and low shrubs without timber trees and dominant species: hill guava (Rhodomyrtus tomentosa), Melastoma candidum, Cratoxylon prunifolium, Randia spinosa, andsiamweed (Chromolaena odorata) etc.

211. The composition structure of the avifauna is characterized as intermediary between the mountainous avifauna and plain avifauna. Here appears the avifauna of the delta ecosystem with the presence of Gavia (Podicipediformes), Crane (Ciconiiformes), Geese (Anseriformes), whose life is associated to the aquatic environment. Their food are aquatic species and they nest and live in areas with waters. The avifauna of this ecosystem also shares some elements of the forest avifauna such as Cuckoo (Cuculiformes), Kingfisher (Coraciiiformes), and Passerin (Passeriformes) .

212. Reptiles (Reptilia) comprise of two orders, of which, the scaled reptiles (Squamata) are more various with 13 families (representing 86.6% of the families), 42 genera (representing 93.3% of genera), 51 species (representing 92.7% of the species). The Testudinata is less various with two families (accounting for 13.3% of the families), 6.6% of the genera, and 4 species (7.3% of the species).

213. The amphibians comprise of three orders with the largest one is Anura comprising seven families, accounting for 77.7% of the families, 21 genera, representing 91.3% of the genera and 32 species, representing 94.1% of the species. The remaining orders include Caudata and Gymnophiona, each has one family (11.1%), one genus (4.3%), and one species (2.9%). According to the report above, In Vac Lake, there are 376 species, including 119 families and 50 orders. According to the species biodiversity, the most abundant plant species with 173 species, of which are dominated by Green algae (102 species), Euglenophyta (40 species), but Silica only 10 species. Next to the algae is the insect with more than 50 representatives and the most diverse is the Lepidoptera (23 species). Birds have 30 species, belonging to 21 families and 10 orders. Drifting species have 37 species, benthos are 34 species with dominant species of mussels. The fishes are 28 species, 10 families and 6 orders, including 17 species of carp. The poor groups in the area are Amphibians, Reptiles and Mamals.

214. In short, the biodiversity in the rivers, lakes within the subproject area is assessed as poor with dominant freshwater species and no migratory fish nor catadromous/anadromous species are found in the project area.

a. Forest management

215. Forest in the province area is classified in three categories: protection, special use and production. In the subproject area of Vinh Yen city, there only some forest areas which all classify as production forest. Some of these will be acquired for the University road component. No protection or special use forest will be affected by the project. This was confirmed by the Department of Agriculture and Rural Development.

5. Socioeconomic Profile

a. Population and demographic

216. Vinh Yen city is a center for administration, politics, economics and culture of Vinh Phuc province. The city has 9 administrative units (7 wards and 2 communes) with total land area of 50.81 km^2, and a population of 118,202 people, and total household population of 25,314 (2014). In the coming years, the administrative territory of Vinh Yen City will be expanded to include some surrounding urban areas, including Phuc Yen and Huong Canh. Vinh Yen City will be renamed Vinh Phuc City and will have a population of approximately 400,000

b. Economic and labor structures

217. Vinh Yen city is only about 63 kilometers from Ha Noi, and is considered a key economic center of the North and being one of eight provinces in the Northern key economic region, a diffused zone of the economic triangle, Hanoi - Hai Phong - Ha Long, a bridge for economic development and cultural exchanges with other regions, provinces and countries.

218. In 2014, the poverty rate in Vinh Yen City was at 2.71%, which was lower than the rate for the Vinh Phuc Province at 7.43%, and the national poverty rate of 5.8% using MOLISA's

calculations. According to the socio-economic survey data, in 2016, the current livelihoods of the households in the project area include: (a) agriculture with rice, vegetable crops and commercial produce, raising livestock and poultry; (b) trade, service; (c) retirement / housework; (d) government officers; (e) self-employed / employed by private companies and (g) unemployed. Household income from: (i) wages / salaries from various sectors (public / private employment) and income from other works; (Ii) selling agricultural products and other goods; And (iii) non-wage income such as savings, pensions and rental income, etc. Total income is calculated based on cash income and does not include living expenses. The average monthly income (from all income sources) of the surveyed households was VND 9.7 million and the monthly income per capita was VND 2.3 million. For each household, the income from all sources divided by the population will output per capita income. The survey found that 762 households (68.5%) reported that their monthly income was stable, of which 351 (31.5%) said their monthly income was unstable.

219. Among the total household population, about 1.43%, or 362 households are poor, and 1.28% or 322 households are close poor in 2014. The communes or wards with the most number of poor and close poor households are Hoi Hop (5.99%), Thanh Tru (5.02%), Dong Tham (3.10%), and Tich Son (3.01%) wards.

c. Cultural Resources

220. There are no cultural relics that are recognized as national monuments of significance, only some local pagodas, temples, churches within the subproject areas, but the closest one is about 500 m away from the subproject components.

d. Land Use

221. Vinh Yen City has 5,081.27 ha natural land:

- Agriculture land: 1,856.48 ha, accounting for 36%;
- Forestry land: 143.46 ha
- Land for special purpose: 1,758.82 ha
- Residential land: 871.18 ha

222. The sections of rivers (Phan, Ca Lo) running through Vinh Yen City are used currently for drainage and flood risk management and also provide irrigation water and there are small fishing activities on these rivers. Vac, Coi Lakes are used for regulating water as well as for aquaculture.

e. Water Supply

223. About 75% of the city's population is served by the piped water system, while the others collect water from groundwater sources. Vinh Quang hamlet, a residential area adjacent to the component "Green Park Development South of Dam Vac Lake" currently uses well for drinking water and the nearest well to the component is about 100 m. The city has two water supply stations for treatment of raw water. The city plans to provide piped water to the entire population.

f. Sewerage and Drainage Network

224. The city uses a combined wastewater and storm water collection system, with some untreated wastewater draining to Dam Vac Lake by gravity flow. Based on the household survey conducted by JICA consultants in 2012 for the feasibility study on revolving fund for household sanitation, only about 70% of the households are connected to the city's sewer system. The remaining 30% of the households dispose wastewater to open spaces, ditches, ponds, and other

water bodies. There is an ongoing commissioning of a domestic wastewater treatment plant with a capacity of 5,000 m3/day, and will collect and treat about 30% of the city's domestic wastewater covering four (4) wards in the city. Only the domestic wastewater flows connected directly to the combined system will reach the plant, however, only few tertiary connections are in place.

V. PUBLIC CONSULTATION

225. The stakeholder consultation strategy developed for the SCDP embodies the principles of meaningful engagement, transparency, participation, and inclusiveness to ensure that affected and marginalized groups such as women and the poor were given equal opportunities to participate in the design of the project, in accordance with the requirements ADB's *Safeguard Policy Statement* (2009).

226. Stakeholder consultations for environment safeguards were conducted in affected Wards and Communes in the three subproject cities of Hue, Ha Giang, and Vinh Yen in the provinces of Thua Thien Hue, Ha Giang, and Vinh Phuc. The approach to stakeholder consultations for environmental concerns or issues with three subproject cities projects consisted of the following avenues of inquiry and data collection:

1) Through questionnaire surveys conducted during the domestic EIA process, conducted by the EIA institutes in collaboration with the city PMUs;
2) During preparation of this IEE, through public meetings with the formal household and Ward/Commune leader consultations, conducted in conjunction with the resettlement team; and
3) From interviews conducted by the SCDP environment safeguard team of the environment and natural resource agencies in each subproject city.

A. Identification of Stakeholders

227. Stakeholders were identified and engaged in a participatory manner. Stakeholder consultations focused on interviews and initial consultations with resource management agencies as part of the interim mission to the three subproject cities. The stakeholders involved in the design of the project included:

- Institutional stakeholders: (i) SCDP EA & IAs and/or PMU; (ii) provincial agencies (e.g., Environment, Agriculture & Rural Development, Department of Transport & Construction, Hue Monuments Conservation Center); (iii) Urban Utilities Management, private sector groups, and chambers of commerce; Women's Affairs;
- Households living near the subproject components who will benefit from the SCDP, and who have an interest in identifying measures to enhance or maximize the benefits of the SCDP;
- Households living near the subproject components who may be directly and/or adversely affected, and who have an interest in the identification and implementation of measures to avoid or minimize negative impacts; and
- Vulnerable and/or marginalized groups who have an interest in the identification and implementation of measures that support and promote their involvement and participation in the SCDP.

B. Discussion Guide

228. Five open-ended questions, and information requests (Table 30) were posed to consultation participants to guide discussions of participants on environmental issues or concerns during the formal joint environment-resettlement consultation meetings. The consultation meetings in each subproject city were opened with a brief ppt presentation to introduce the project, and individual subproject components.

Table 32. Guiding questions and information for stakeholder consultations

1. What will be the benefits of the subproject components of your city?

   Please list benefits of individual subproject components.

2. Do you have any environmental concerns with any of the subproject components in your city?

   Please identify environmental concerns of individual subproject components.

3. Do you any have environmental concerns with the **construction activities** of any subproject component?

   Please identify any environmental concerns of construction activities of the subproject.

4. Do you have environmental concerns with the **completed operation phase** of the subproject components?

   Please identify any environmental concerns of the operation of completed subproject.

5. Do you think the subproject design or operation should be changed to prevent negative environmental, or community impacts?

   Please identify changes to the subproject that you think will prevent or reduce negative environmental, or community impacts?

229. To help orient the discussions on environmental issues and concerns of the subproject a list of example environmental components (Table 31) were introduced to the stakeholders ahead of the question and answer period. The stakeholders were encouraged to add their own components of environment to the discussions.

Table 33. Environmental components used to guide stakeholder discussions.

• drinking water quality and availability • surface water quality and quantity • groundwater quality and quantity • air quality • climate • land and soil quality • rivers, canals, lakes, reservoirs, • trees, other vegetation, • terrestrial and aquatic animals, e.g., fish, birds, small mammals	• ecological protected areas (e.g., national parks, wildlife sanctuaries), • land and surface water uses (e.g., agriculture, fisheries, forestry, navigation, aquaculture, commercial, other), • public safety • public movement and access • physical cultural values (e.g., Citadel, pagodas, cemeteries, monuments)

C. Subproject Consultations

1. Ha Giang City

230. During preparation of the domestic EIA (2016), a series of public consultation events were undertaken to meet GOV legislative requirements for EIA preparation. These events were arranged by Ha Giang PMU with assistance of EIA consultant. While the public consultation were limited in scope, they provided an initial view of the types of issues identified by the local community that may require consideration in the IEE (Table 32).

Table 34. Consultation activities of national EIA

Event	Objectives	Date	Participants	Results of public consultation
Consultation with representatives of local authorities, affected people through meetings held at commune/ward people committees.	- Disclose project description (location, road alignment, basic design…) - Gather information on local environmental baseline data - Gather local concerns on negative environmental impacts by the project	28th October 2014 at Phuong Do Commune and Phong Quang commune 29th October 2014 at Nguyen Trai ward and Tran Phu ward 3rd November 2014 at Minh Khai ward and Phuong Thien commune 5th November 2014 at Ngoc Ha ward and Ngoc Duong commune	Representativies of - Ha Giang City People Committee - Ha Giang PMU - Ward People Committees and other ward's political and social organizations - EIA consultant - Households living within the project area and some heads of hamlet, village, group. **Number of participants** - Quang Trung ward: 25 - Ngoc Ha ward: 20 - Nguyen Trai ward: 30 - Minh Khai ward: 40 - Tran Phu ward: 20 - Ngoc Duong com: 20 - Phuong Do com: 20 - Phuong Thien com: 20 - Phong Quang com: 20	• Local authorities and people all support the project. • They want PMU & construction contractors to comply with mitigation measures during construction time • The construction progress has to meet schedule & should not have delays • Construction progress should be communicated regularly to local authorities • The PMU must prepare appropriate compensation plan for affected people

231. During the IEE, consultations on environment issues and concerns were conducted in the form of focus group discussions following the guide introduced above. Public consultation meetings were organized in culture houses of wards/hamlet within the subproject area. The details are shown in Table 33.

Table 35. Consultation activities taken for the IEE preparation

Location	Date	Participants	Number of participants		
			Man	Women	Total
Minh Khai ward, Ha Giang City	6th March 2017	Ha Giang PMU Ward People Committee Heads of residential groups Affected households	11	9	20

Phu Linh commune, Vi Xuyen District		Ha Giang PMU Commune People Committee Heads of hamlets Affected households	22	3	25
Phuong Thien commune, Ha Giang City	7th March 2013	Ha Giang PMU Commune People Committee Heads of hamlets Affected households	16	9	25
Nguyen Trai Ward, Ha Giang City		Ha Giang PMU Ward People Committee Heads of residential groups Affected households	15	20	35

232. Table 34 summarizes the outcomes of consultation activities for environment conducted during preparation of the IEE.

Table 36. Results of public consultations for environment in Ha Giang

Location	Issue or Concern	Response of consultant & EMP
Minh Khai ward	The southern ring road possibly crosses a local pond about 3 ha in group 1 that currently is used for aquaculture. Construction activities may affect the pond water quality and fish productivity of the pond.	The project will not directly impact the pond. This will be confirmed during detailed design. If the water source is affected by the project, mitigation measures to avoid/ prevent/mitigate negative impacts will be prescribed in EMP for application. Measures to protect all ponds will be prescribed in EMP such as prohibiting storage of construction materials within 50m to water sources; building temporary drainage to assure wastewater from construction not to be discharged into water sources; and prohibiting to dispose any type of wastes into water sources The EMP [as already agreed by PMU] will assign environmental management/engineers in PMU to work along with Project Management Consultant (PMC) who will be responsible for supervising and ensuring these the implementation of these, and other impact mitigation measures The quality of potentially affected water sources will be monitored as part of EMP.
	Mr Nguyen Tan Trong – group 1 There is an area that is flooded sometimes. This area is close to the beginning point of the Ring Road. Suggested the height of the road should be increased up to 1.6m comparing with the height of current road	At a minimum by design, the height of road must comply with Vietnamese road design standards and the possibility of connecting with existing local roads. Additional, road grade will also consider local flooding frequency and severity, and potential impacts of climate change on rainfall and flooding. This issue has been noted and shall be sent to detail design consultant.

Phu Linh Commune	Mr Nguyen Van Duong – hamlet 7 He informed that there are about 4 households who are fishing along the Lo River. Due to the close distance with the Ring Road, during construction and operation phase, noise, dust, machine operation could affect their fishing. He asked for the solution to handle this impact when the fishing is the main income of his family.	The EMP will prescribe requirements to manage construction disturbances/impacts such as noise, dust, and erosion & sedimentation on Lo River. Mitigation measures for these impacts shall be designed such as covering all construction materials (sand, soil); requiring regular maintenance for all machine and vehicle; do watering at least 3-4 times per day. Moreover, local fishers will be given schedules of construction of Ring Road to enable fisher families to optimize their fishing schedules to avoid earthworks. These measures shall be supervised by qualified environmental engineers of PMU and PMC. Noise and dust will be monitored as part of EMP.
Phuong Thien Commune	Ms Nguyen Thi Xoan – Chang hamlet She informed that sometimes, squirrels from an adjacent forest went to the Me stream for food and she is concerned construction workers would set traps or shoot these small mammals.	EMP will include directive that construction workers are prohibited from setting animal traps, hunting, or fishing during the project implementation. This rule shall be supervised by not only PMU, PMC but also local community.
	Mr Nguyen Van Ngan – Chang hamlet Tay people have a custom to hang tree branches above house gate in order to refuse uninvited guests. This custom should be disseminated to outside workers (if any)	The EMP will ensure that all construction workers including foreign workers learn and abide by customs of all local residents and community including ethnic groups such as Tay people. This requirement similar to the entire EMP will be included in the contractor bidding documents specifying requirement that local customs must be understood and followed. The compliance with local customs shall be supervised by not only PMU, PMC but also local community.
	Mr Mai Trung Tin – Chang hamlet He was very worried on the safety of the other side of Me stream which is not embanked. He supposed the flooding will be more serious for this side if the embankment is built.	The embankment of Me river was selected because it is considered to be most sensitive to flooding and needs protection. The new embankment is not expected to influence flow along the opposite bank. However, the sensitivity of opposite bank to the subproject will be reviewed at detailed design stage as part of the initiation of the EMP. Further, this issue shall be noted and sent to Ha Giang PMU. An assessment of potential negative impacts on opposite bank in regards of construction of other side embankment (if any) will be prepared by technical consultants and shall be sent to ward people committee.

	Mr Mai Trung Tin – Chang hamlet He warned that if construction progress is slow and does not finish before rainy season (June to September), flooding could damage the construction works	Before construction begins contractors are required to prepare a construction schedule that includes appropriate activities during the rainy season if necessary. This schedule is approved by the PMU with the assistance of PMC. All major works shall be finished before flooding season. The construction progress shall be supervised strictly by the PMU and PMC.
	Mr Mai Trung Tin – Chang hamlet He is concerned that construction wastes could be disposed into the stream	As part of surface water protection the EMP will specify that all construction activities must stay away from stream, and construction waste must be disposed of in designated DONRE-approved locations. Throwing garbage, disposing soil, solid waste into natural water sources are prohibited. Solid waste management shall be supervised strictly by the PMU, PMC and local community.
Nguyen Trai Ward	Nguyen Van Duyen – group 13 He is concerned that construction wastes could be disposed into open canal	As above. Solid waste management shall be supervised strictly by the PMU, PMC and local community.

233. The list of participants of the Ha Giang public consultation meeting is presented in Appendix A.

2. Vinh Yen City

234. Similar to Ha Giang, a series of public consultation events were undertaken as part of the national EIA. The events were arranged by Vinh Yen PMU with assistance of EIA consultant. A summary of the public consultation for the domestic EIA is shown in Tables 35 and 36. The results of the consultation conducted for IEE are summarized in Table 37.

Table 37. Consultation activities taken as part of domestic EIA

Event	Objectives	Date	Participants	Results of public consultation
Consultation with representatives of local authorities, affected people	- Disclose project description (location, road alignment, basic design…) - Gather information on local environmental baseline data - Gather local concerns on negative	8th March 2016 Ngo Quyen ward 11th March 2016: Khai Quang ward and Thanh Tru commune 14th March 2016: Tich Son and Dong Da wards and Kim Long commune 16th March 2016 Dong Tam ward	Representativies of - Vinh Yen PMU - Ward, commune People Committees and other ward's political and social organizations - EIA consultant - Households living within the project area	Local authorities (e.g., commune, CPC, PPC, social orgs) all support the project. Local communities expressed concerns as follows: - Where is dredging material disposed, and what are negative impacts of the disposal of dredging material. - Some areas within project area are flooded. The project needs practical measures to solve these floodings.

Event	Objectives	Date	Participants	Results of public consultation
	environmental impacts by the project	17th March 2016 Dong Cuong and Lien Bao wards 18th March 2016 Thanh Van commune	and some heads of hamlet, village, group. **Number of participants** Ngo Quyen ward: 18 Khai Quang ward: 32 Thanh Tru com: 25 Tich Son ward: 16 Dong Da ward: 21 Kim Long com: 33 Dong Tam ward: 28 Dong Cuong ward: 26 Lien Bao ward: 22 Thanh Van com: 21	- Construction activities can cause negative impacts on local traffic and trading activities. - Local ponds, lakes are polluted and it is needed to be dredged. - Construction activities have to avoid negative impacts on agricultural activities. - The project should do research on local domestic waste water. - They requested that the PMU's construction contractors must comply with mitigation measures during construction time. - The construction progress must meet the schedule, and should not have any delays. - The construction progress should be communicated regularly to local authorities. - The PMU must prepare appropriate compensation plan for affected people

Table 38. Public Consultations for Environment in Vinh Yen during IEE

Location	Date	Participants	Number of participants		
			Man	Women	Total
Hoa Hop ward, Vinh Yen City	9th March 2017	Vinh Yen PMU Ward People Committee Heads of residential groups Affected households	13	8	21
Thanh Van commune, Vinh Yen City	9th March 2017	Vinh Yen PMU Commune People Committee Heads of hamlets Affected households	22	3	25
Thanh Tru commune, Vinh Yen City	10th March 2017	Vinh Yen PMU Commune People Committee Heads of hamlets Affected households	37	14	51
Quat Luu commune, Vinh Yen City	10th March 2017	Vinh Yen PMU Ward People Committee Heads of residential groups Affected households	9	5	14

Table 39. Results of Public Consultations for Environment in Vinh Yen during IEE

Location	Issue or Concern	Response of PMU / Consultant / ADB-EMP
Hoa Hop ward	Ms Le Thi The: She is concerned about bad odour during operation of WWTP because her house is close to the WWTP (200 m far away).	PMU officer responded: (i) the WWTP will apply biological technology for treatment process. This technology produces less bad odor than other technologies. In first year of WWTP operation there will be a environmental independent consultant who assesses negative impacts of WWTP and proposes corrective action plans if needed. ADB's consultant responded that WWTP is designed and constructed based on Vietnamese regulations and the location of WWTP is at least 200 m far away. Based on the design, the WWTP will be surrounded by dense tree "fence".
	Ms Le Thi Yen: In dry season some areas of Dam Coi lake can be used for agricultural purposes. She is worried during the operation of WWTP, with capacity of 6000 m^3, the effluent from the WWTP could flood these agricultural areas.	PMU officier responded that all damages caused by operation of the WWTP will be compensated, and the agricultural areas within Dam Coi lake could be accquired if necessary and compensated according to the project resettlement policy.
Thanh Van Commune	Mr Nguyen Van Dong – Trai hamlet: He informed that most of local rural roads are light-load roads. During construction phase, heavy trucks could damage these existing local roads.	ADB's consultant responded that: (i) the contractors take all responsibilities of compensating or restoring for any damages of local infrastructures in result of construction activities; (ii) before construction commencement, the PMU, contractors and local authorities conduct joint site visits to prepare written agreement minutes on current condition of local infrastructures; these minutes shall be one of proofs for compensation or restoration if any damage happens; and (iii) the EMP will require contractors to comply with traffic sign boards including road load sign boards.
	Concerned the construction of road could affect agricultural activities by demolishing irrigation and drainage canals on local fields.	ADB's Consultant responded that during the detail design, technical/engineering consultant shall do site surveys including all irrigation, drainage systems affected by the road. Based on these surveys, alternatives for the demolished canals are designed to assure local irrigation and drainage capacity as same as before road construction.
	Concerned that during construction phase there will be many construction vehicles that use local roads and it will affect on local traffic and increase the risk of traffic accidents for local people	ADB's Consultant responded that before construction commencement, contractors must prepare a traffic management plan to minimize local traffic disruptions, and negative impacts of construction truck traffic. The traffic plan includes identifing local roads needing to be blocked, time

		and permits for the blocking; the routes used for material and solid waste transportation; construction of access roads; assigning traffic staffs at crowded traffic area street junctions.
	Concerned that the construction and operation of the road will increase the risk of flooding for local areas. If the flooding lasts for long time and it can be affect the quality of water sources for domestic purposes	ADB's Consultant responded that during detail design stage of subproject technical/engineering consultants shall conduct more detailed surveys of flood prone areas with history of flooding, local drainage and irrigation system in order to ensure construction and operation of new road will not change existing drainage capacity and behaviour, and that new road is not negatively affected by existing drainage/flood regime.
Thanh Tru Commune	Do Ngoc Cu – Vinh Quang hamlet: Dredging activities shall affect some local households who are fishing on Dam Vac lake	ADB's consultant responded that dredging activities would temporarily affect water quality, and might impact fishing. However, impacts will be minimal and contained to small areas due to the planned technique of dredging small bermed cells of lake at a time, not conduct open lake dredging. All local households impacted by project activities shall receive compensation and support programs based on safeguard policy of the project.
	He also asked where is the dredging material disposed ?	ADB's consultant responded that because the national EIA confirmed lake/river sediment quality is not contaminated dredged sediment can be used as soil for plantations, however, most if not all dredged material shall be used to infill and create Green Park at south end of Dam Vac lake.
	Mr Bui Duc Manh – Vinh Quang hamlet: Local water sources for domestic purposes have been polluted so I wish the project could invest for Vinh Quang hamlet a clean water supply system.	ADB's consultant responded this issue is out of scope of the project and we only can take a note for the issue and send it to the PMU/CPC for reference.
	Do Ngoc Cu – Vinh Quang hamlet: The project proposes to acquire a part of agricultural land for the component green park. But for the remaining agricultural lands currently draining water to Dam Vac Lake through this acquired land, how they can drain when the park is leveled up to 3-5m as an embankment to prevent draining water from remaining agricultural land to Dam Vac Lake.	PMU officer responded that a canal shall be built to drain water from remaining agricultural land to Dam Vac Lake. This canal crosses through the park and connect the remaining land to a lake in the park and then to Dam Vac Lake. The dimension of the canal will be calculated in the detail design based on surveys on local hydrology and hydraulics and flooding conditions. ADB's consultant responded by indicating that at detailed design phase this and other potential drainage impact issues will be studied closely to ensure final design of Park does not create drainage or flooding problems. PMU will send the final design of the canal to local authorities for public consultation when it is available. And local community can supervise this construction of canal following the approved design.

	He informed that currently, domestic wastewater of Vinh Quang hamlet is discharging into the acquired areas by the project. If these areas acquired and leveled up 3-5m, where does domestic waste water of Vinh Quang hamlet go?	PMU officer responded that Vinh Phuc Province People Committee has a plan to build a sewer system to collect domestic waste water of this area. ADB consultant added that at detailed design technical/engineering consultant will work with the PMU to examine more closely potential impact of subproject on domestic wastewater and drainage management, and scope of required collection system for current wastewater. More detailed information to be provided by PMU and from local authorities.
Quat Luu Commune	No serious concerns/issues related to environment	

235. The list of participants of the Vinh Yen public consultation meeting is presented in **Appendix A**.

3. Hue City

236. A summary of the public consultation for the domestic EIA is shown in Table 38. The results of the consultations conducted for IEE are summarized in Tables 39 and 40.

Table 40. Consultation activities of domestic EIA

Event	Objectives	Date	Participants	Report of public consultation result
Consultation with representatives of local authorities, affected people	- Disclose project description (location, road alignment, basic design…) - Gather information on local environmental baseline data - Gather local concerns on negative environmental impacts by the project	5th April 2016: Phu Son commune 6th April 2016: Thuan Loc, An Hoa wards 7th April 2016: Phu Thuan, Kim Long, Phu Hoa wards and Thuy Van Commune 8th April 2016: Thuy Bieu wards 11th April 2016: Xuan Phu, Tay Loc, Thuan Hoa, Phu Hau wards 12th April 2016: Thuy Xuan ward	Representativies of Hue PMU, Ward People Committees, other Ward political and social organizations, EIA consultant, and households living within the project area **Number of participants:** Xuan Phu ward: 18 Tay Loc ward: 11 Thuan Hoa ward: 11 Phu Hau ward: 12 Thuan Loc ward: 12 An Hoa ward: 11 Phu Thuan ward: 12 Thuy Van commune: 12 Thuy Xuan ward: 10 Phu Son commune: 14 Kim Long ward: 11 Thuy Bieu ward: 11 Phu Hoa ward: 11	Local authorities and people all supported to the project They requested PMU, and construction contractors to comply with mitigation measures during construction period. The progress of construction must meet the schedule, without delays. Local authorities should be regularly informed of progress of construction. The PMU must prepare appropriate compensation plan for affected people

237. During the IEE, consultations on environmental issues and concerns were conducted in the form of focus group discussions based on the guide summarized above. Public consultation

meetings were organized in culture houses of wards/hamlet within the subproject area. The details are shown in Table 38.

Table 41. Consultation activities taken for the IEE preparation in Hue City

Location	Date	Participants	Number of participants		
			Man	Women	Total
Xuan Phu Ward, Hue City	20th March 2017	Hue PMU Technical consultant Ward People Committee Heads of residential groups Affected households	23	2	25
Vi Da Ward, Hue City	20th March 2017	Hue PMU Technical consultant Ward People Committee Heads of residential groups Affected households	20	3	23
Thuy Bieu Ward, Hue City	21th March 2017	Hue PMU Technical consultant Ward People Committee Heads of residential groups Affected households	23	8	31
Phu Binh Ward, Hue City	21th March 2017	Hue PMU Technical consultant Ward People Committee Heads of residential groups Affected households	18	5	23

Table 42. Results of Public Consultations for Environment in Hue

Location	Issue or Concern	Response of consultant / EMP
Xuan Phu ward	Ho Van Dong – Group 1, Xuan Phu Ward: Concerned about dusty condition and the risks of traffic safety during construction phase	ADB's consultant responded: for construction and operation phase, noise, dust are common negative disturbances that can't be avoided. However, the EMP prescribes mitigation measures to reduce these disturbances such as covering all construction materials (sand, soil); requiring regular maintenance for all machine and vehicle; do watering at least 3-4 times per day; Regarding traffic safety, construction contractors shall be required to prepare a traffic management plan prior to construction commencement, this plan will be revised and approved by DOT and HPMU. These measures also shall be supervised by qualified environmental engineers of PMU and PMC. Noise and dust will be monitored quartely.
	Concerned that construction of the proposed road, some irrigation canals	ADB's consultant responded: Technical-engineering consultants during detail design shall

Location	Issue or Concern	Response of consultant / EMP
	shall be demolished and local rice field shall be affected.	conduct surveys on local irrigation system and all demolished irrigation canals are replaced by new canals to assure providing sufficiently water to local rice field at least as before having the project. Also, the new canals shall be built before construction of road.
Vi Da Ward	Mr. Ngo Quang Ngu – group 13B, Vi Da ward: He informed meeting that current road does not have separated lanes for pedestrian, so there were accidents of pedestrian with traffic vehicles. He expects that the upgraded bridge and access road component would design the separated lanes for pedestrian.	Technical consultant responded: yes, according to the design, the bridge and access road will have sidewalks for pedestrians.
	During rainy season, the areas along Vi Da bridge were flooded, the project needs to have an appropriate design to avoid making the flooding more serious	Technical consultant responded based on hydrological and hydraulic calculations, the drainage system of the access road shall be built to assure to storm runoff will be diverted to Nhu Y river without causing local flooding.
	Mr Tong Phuoc Viet – group 13B, Vi Da Ward: He informed meeting that there have been about 100 households who have been doing aquaculture along the section of Nhu Y river proposed for embankment. Construction of bridge and embankment could affect severely their aquacultural activities. The project needed to have compensation or supporting policies for these households.	ADB's consultant responded: The long and short-term scheduling of bridge construction will be given to all local fishers and aquaculturists in Nhu Y river to allow them to move or plan their activities to avoid the construction. If during construction phase, aquaculture or fishing must be stopped temporarily by project activities, the loss of income also will be compensated following resettlement policy of the project. The quality of surface water will be monitored during construction phase by independent consultants. Any change of the quality is informed to local authorities and if any damages such as death fish caused by project activities also are compensated.
	Wastewater of households of group 13B has been currently discharging to the sewer along the existing road. For expanding the road, the current sewer shall be demolished and where will the wastewater go?	ADB's consultant responded: temporary drainage and sewer shall be built for rain water and domestic wastewater before construction commences to assure the drainage for local areas. This requirement also is indicated in the bidding documents and the contract of construction contractors.
Thuy Bieu commune	Dang Duc Tinh – Group 2: He is very concerned about the slow progress during construction phase like other projects implemented before in local area and requested construction contractors to construct	ADB's consultant responded: during construction phase, construction progess will be supervised strictly and managed to follow approved construction schedule by both Hue PMU and ADB. A construction method is prepared by construction contractors and is revised/approved by supervision consultant as well as Hue PMU to make sure to be suitable with local condition.

Location	Issue or Concern	Response of consultant / EMP
	the road by sections, finishing each section before starting another section.	
	He is concerned about dusty condition and the risks of traffic safety during construction phase	ADB's consultant responded: for construction and operation phase, noise, dust are common negative disturbances and can't be avoided. In EMP, the mitigation measures will be prescribed for these impacts such as covering all construction materials (sand, soil); requiring regular maintenance for all machine and vehicle; do watering at least 3-4 times per day; Regarding traffic safety, construction contractors shall be required to prepare a traffic management plan prior to construction commencement, this plan will be revised and approved by DOT and HPMU. These measures also shall be supervised by qualified environmental engineers of PMU and PMC. The noise and dust will be monitored quarterly.
	He also is concerned about construction materials and solid wasted being stored/disposed in areas too close local houses, on local roads cause risks of traffic safety	ADB's consultant responded: disposal sites and areas for gathering construction material will be identified during the detail design of the project and with specific directions included in the bidding documents for construction. These sites and areas have to obtain written agreement of the proper owners and approvals of DONRE for disposal sites.
	Ton That Dao – President of commune: He informed meeting that existing drainage and culverts of the road are not capable for draining water during rainy season. The project should consider carefully on this aspect in detail design.	ADB's consultant responded: Yes, these issue are included in engineering designs. PMU and design consultant will be notified of concerns.
	He also informed meeting that there are two ancient trees (about more 100 years) may be within the ROW of the expanded road	Technical consultant responded: during detail design, the road alingment can and will be adjusted to avoid impacts on all ancient trees.
Phu Binh Ward, Hue City	Nguyen Tang Ty – Group 3: He is concerned about dusty condition during construction phase	ADB's consultant responded: for construction and operation phase, noise, dust are commen negative impacts and cannot be avoided. In EMP, mitigation measures for these impacts shall be designed such as covering all construction materials (sand, soil); requiring regular maintenance for all machine and vehicle; do watering at least 3-4 times per day. These measures will be supervised by qualified environmental engineers of PMU and PMC. Noise and dust will be monitored quartely

Location	Issue or Concern	Response of consultant / EMP
	Nguyen Thanh Phuong – Ward President: He also informed that there is an ancient tree (about 100 years) may be within the Dong Ba embankment component area	Technical consultant responded: based on experience of former embankment projects implemented in Hue City, most of big trees were not cut or removed, they were integrated in landscape design of these projects. All “old growth” trees will be protected.

238. Given the sensitivity of the Complex of Hue Monuments in Hue, the Hue Monuments Conservation Center (HMCC) was consulted to clarify cultural resource management and protection requirements and assess the project's compliance with existing plans. The HMCC is placed directly under the Thua Thien Hue Provincial People’s Committee, and is the institution responsible for the management of the UNESCO world heritage site in Hue, and the protection of its outstanding universal value. Apart from responding to the responsibilities of the State as party to the Convention on the Protection of the World Culture and Natural Heritage, HMCC establishment also complied with the stipulations of the Law on Cultural Heritage (No. 28/2001/QH10), revised in 2009 by Law Amending and Supplementing a Number of Articles of the Law on Cultural Heritage (No. 32/2009/QH12). Staffed by more than 700 people from many different professional backgrounds, HMCC deals with all issues including zoning, research, tangible and intangible heritage preservation, traditional material reproduction, visitor management, as well as the planning and protection of the landscape setting and associated features in the buffer zone and immediately surrounding area.

239. Two meetings took place, including in September 2015 (during the PPTA) and in January 2017 (in the framework of this IEE). In the January 2017 meeting the HMCC confirmed that it has reviewed the feasibility study and domestic EIA prior to prior to PPC’s approval, making sure that proposed activities included therein (i) adhere with the Management Plan of the Complex of Hue Monuments for the Period 2015-2020; and (ii) are not located within the core or buffer zones of any protected heritage site. Meeting findings of the September 2015 meeting are presented below.

Table 43. Consultation meeting with Hue Monuments Conservation Center (HMCC)

Date	Institutions/Persons Consulted	Position	Key Notes
03 Sep 2015	Mr. Phan Thanh Hai	Director	**Objectives of the consultation:** - To discuss about the proposed subprojects within the Citadel, which is involving works at the banks of the Royal Canal (world heritage properties inside the Citadel.) - To obtain HMCC’s comments and their environmental requirements regarding the works. According to V-Dir. Tuan: - Works must follow HMCC rules to ensure the river will not be polluted. - Works to follow existing design. - If works are new, to discharge only stormwater. If also conveying wastewater, wastewater must be treated before discharge. According to Mr. Nghia, works at the banks of the Royal Canal will involve only existing discharge points. [38]
	Mr. Phan Van Tuan	Vice Director	
	Mr. Nguyen Van Phuc	Office Manager	
	Mr. Van Viet Nghia	Staff, Hue PMU	

[38] These discharge points are on the Royal Canal, part of the core zone of the protected heritage site, and as such not eligible for financing under the Program.

Date	Institutions/Persons Consulted	Position	Key Notes
			According to Dir. Hai: - If following existing drainage system, no problem. - Detailed design will be submitted to the PPC and PPC will forward to the HMCC for review and comments. PPTA Team brought up the proposed improvement of the Citadel canal/moat, which is outside the walls of the Citadel, and inquired on precautionary requirements. - Dir. Hai replied that in between the canal and the Citadel wall is a strip of land, about 6 m wide, as buffer. It should provide sufficient protection of the walls. HMCC is willing to monitor the works and verify the monitoring results. Dir. Hai expressed HMCC's willingness to monitor the works close to the Citadel and hoped that the subproject will materialize as it will improve the environmental quality in and around the Citadel and protect the heritage structures.

240. Participants of the Hue public consultation meeting is presented in Appendix A.

D. Summary of key issue or concerns of community

241. The environmental consultant received different feedback from the public consultation meetings in the three cities, and among the different Wards in individual cities that range from issues with local environmental conditions, infrastructures and ideas, and concerns on subproject components.

242. All participants consisting of local authorities, affected households and heads of residential groups agree with, and support the project and understand the benefits from the project such as improving local sanitation condition by drainage components, improved living standards through easy and safe transportation and flooding management by dredging and embankment components.

243. Local people, however, have raised some concerns related to environmental aspects on the project activities during three phases of project. A summary of concerns identified from the public consultantions is presented as follows:

244. During detail design phase, concerns focused on: (i) the road alignments that could affect their land and house; (ii) existing drainage and sewer system would be negatively affected by the project & new design system; (iii) the locations of embankment; (iv) potential impact on old trees.

245. During construction phase, concerns focused on: (i) temporary drainage and sewer system to assure the capacity for flood domestic wastewater management is maintained during construction period (ii) dusty conditions, noise and damages of infrastrutures caused by construction vehicle; (iii) fishing and agricultural activities negatively affected.

246. During operation phase, concerns focused mainly on (i) the risks of traffic accidents for new road components; and (ii) wastewater treatment plant operation.

247. All local concerns were discussed among participants and addressed at the meetings by the subproject PMU officers, ADB's consultants, and Technical consultants (as summarized in above Tables).

VI. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATIONS

A. Common Subproject Components

248. To avoid or minimize redundancy with the assessment the potential environmental impacts of the three subprojects in Hue, Ha Giang, and Vinh Yen are assessed for common subproject component types, not for the 32 individual subproject components that are presented in Chapter III. Impact mitigation measures are identified for the component types which are applied component specifically where necessary.

249. The subproject components presented in Chapter III are grouped into five component types according to common activities and affected environments within the two component themes of the subcomponents from Chapter III[39] which are summarized in Table 42.

Table 44. Five common subproject components of two themes of SCDP

Component Theme / Type	Number of Subproject Components		
	Hue	Ha Giang	Vinh Yen
Green & Climate Resilient Urban Development			
Embankment Developments, Dredging	7	3	1
Parkland Development	2	-	2*
Stream-drain Rehabilitation		4	-
New Wastewater Networks & Treatment, Water Supply	1	-	2
Integrated Urban Road Network Development			
New and Upgraded Roads, Drainage, Bridges	5	4	1*

* Two components allocated to “Economically Competitive City Development” theme in Chapter III, as per PAM.

B. Benefits of Subproject Components

1. Green & Climate Resilient Urban Development

a. Embankment Developments & Dredging

250. Dredging of the different lakes and rivers of Hue and Vinh Yen will result in improved water quality due to the increased assimilative capacity of the larger standing volumes of the water bodies for wastewater and pollutant inputs. Removal of a large portion of the organic rich, anoxic bottom sediments will also contribute to improved water quality after the initial resuspension of bottom sediment resettles and discharges to Phan river following dredging. The improved water quality will increase dissolved oxygen which in turn will enhance animal and plant habitat in the lakes of the Citadel in Hue in particular. The deepened river and canal channels will increase the

[39] Themes taken from three post January & February 2017 MoUs between PMUs and ADB.

existing capacity for navigation in the rivers and canals. Flow through the rivers and canals will be improved during rainfall events, improving flood retention capacity.

251. The new and rehabilitated river and lake embankments in Hue, Ha Giang, and Vinh Yen with the various green-concrete & gabion slope design options for the different embankments will stabilize the embankments by preventing erosion and slumping. In particular will be the impact of the new embankment sections planned for the erosion zones of the Nhu Y River in Hue and along sections of the the Lo and Mien Rivers in Ha Giang. The heightened embankments around the lakes of the Citadel will act to increase storage capacity of the lakes during heavy rainfall events thereby reducing local flooding.

252. In addition to reducing erosion and bank slumping the new and rehabilitated landscaped embankments will provide extensive linear green space for parks and promenades for local residents. The treed and vegetated embankments will provide significant green space value to the urban areas, and will improve access of local residents to enjoy the rivers and lakes. The vegetated embankment tops also provide natural structure to moderate runoff and allow rainfall infiltration thereby further reducing embankment erosion.

b. Parkland Development

253. Similar to the landscaped embankments, the parkland developments in An Duong in Hue and at the south end of Dam Vac Lake in Vinh Yen will provide extensive community green space for recreation and leisure activities, and will provide natural surfaces for rainfall infiltration and local aquifer recharge. The comparatively large new park areas will also help small commercial business to support the new recreation and leisure activities afforded by the parks which will act to strengthen local economies. The new urban parks will strengthen community awareness of the importance and value of “green city” development and preservation in Hue and Vinh Yen.

c. Stream-drainage Upgrades

254. Rehabilitation and removal of debris from the mostly vegetated stream-drains in Ha Giang will help to restore the natural flow of the streams, and prevent local flooding from debris-blocked stream sections. While placement of some concrete box culverts are needed to direct flow and curb erosion under small access roads, around houses and at the outfalls to the Lo and Mien Rivers, the longer sections of restored vegetated embankments are very important because they will act to increase to natural capacity of the streams to moderate flood waters caused from heavy rainfall events. Moreover, the cleaned and restored, vegetated stream banks will also act to restore the natural assimilative capacity of the streams for the domestic wastewater loads received from adjacent households. However, as indicated below DANIDA is planning to build a wastewater collection and treatment system for domestic wastewater that is currently being disharged to the streams.The cleaned and restored natural stream drainages will expand the green space of the city while improving runoff and reducing local flood events and associated property damage. The restored, unobstructed stream courses will be better able to accommodate increases in rainfall intensity expected from climate change without local flooding.

d. New Wastewater Networks & Treatment, Water Supply

255. Expansion of the wastewater collection network and treatment capacity in Vinh Yen will immediately raise household standard of resident living while also broadly increasing the environmental quality of the urban area. In particular the yards, streets and sidewalks of the neigbourhoods receiving wastewater collection will become cleaner with less ambient odour.

256. The significant reductions in total organic load (i.e., BOD/COD), ammonia, and coliform bacteria to Dam Vac Lake and Phan River from the treatment of the estimated 5000 m3 of domestic wastewater will increase water quality in these two major green-environmental areas of the city. The new wastewater treatment plant will meet level B (irrigation waters) of the QCVN standard for industrial waste. The improvements to the quality of Dam Vac Lake will greatly contribute to the overall aesthetics success of the new Green Park that will be constructed at the south shore of the lake. The increase in water quality will improve habitat for aquatic biota, which should lead to greater biodiversity. The decrease in organic pollution loads to Dam Vac Lake and Phan River will offset the impact on water quality of potentially lower dry season lake and river levels which may occur from climate change.

257. Similarly, the provision of a potable water supply to villages south of Hue will raise the standard of living while facilitating the greening of recipient homesteads and villages from increased access to water. The drinking water will come from an existing WTP north of the villages that will supply water to an industrial park. Clean water (meeting QCVN standards for potable water) will be supplied to 530 households in Pho Son village. Community health will improve, and work days lost to gastrointestinal disorders will decrease. The new water supply will augment the decreasing groundwater yields experienced during the dry season which may become more severe from climate change.

e. Integrated Urban Road Network Development

258. The new and upgraded roads and bridges in Vinh Yen, Ha Giang and Hue will improve traffic flow, reduce congestion, and will eventually strengthen the local economies, and diversify cultural development in the three cities. In particular, the road developments targeted for tourism and University development in Hue and Vinh Yen will strengthen local economies and raise standards of living in the cities.

259. The upgrades to lateral drainage network of select streets in the Citadel in Hue will reduce local flooding as a result of the increased capacity of drainage network, and the moderating effect of the bioswale storage of runoff. However, the integration of bioswales into the head of the drainage system will also significantly green the street scape from the vegetated road shoulders and trees that are integral to the structure of the bioswales.

C. Subproject Component Impacts and Mitigations

260. The potential environment impacts of the different types of subproject components summarized in Table 29 are delimited by the Category B status of the SCDP. During feasibility study, all components proposed for inclusion in the project scope were assessed through site visits to ensure that these would not trigger ADB's category A for environment, with potential significant, unprecedented and irreversible impacts. As a result, several components were excluded from the project scope. In Hue, the proposed Improvement to Citadel Canal/Moat component, and the proposed Eco-channel of the An Duong Development Area component were excluded because those components triggered Category A conditions (SPS 2009) due to being located in the core zone of a site listed in the Complex of Hue Monuments (a UNESCO World Heritage site), and requiring extensive local hydrological study, respectively. In Ha Giang, the proposed Improvement of Existing Landfill component was excluded as would have required a comprehensive environmental site assessment to identify current levels of contamination and risks during rehabilitation, which was not feasible with the resources and time constraints during project preparation. The remaining components all classify as category B investments, not

anticipated to cause significant, irreversible and unprecedented impacts. The B categorization was confirmed by ADB's Chief Compliance Officer in April 2017.

1. Impact Screening

261. The relative levels of potential impact of the Cat B component types were screened with a qualitative impact scale from *High – No Impact* (Table 43). The potential impact scale was subsequently applied to a simple impact matrix (Table 44) of component type against likely environmental component to be affected during the three phases of SCDP implementation defined by *Pre-construction, Construction, and Operation.* The relative impacts allocated in Table 31 are subsequently discussed at the individual subproject component level where necessary for further clarity. The positive impacts of the component types summarized above are left out of impact matrix.

Table 45. Impact levels of subproject component types (Category B)

Impact level	Symbol	Description
High	H	Maximum change or disturbance to environmental receptor throughout duration of component activity
Moderate	M	Noticeable change or disturbance of environmental receptor periodically during component activity
Low	L	Change or disturbance of environmental receptor within normal response surface to non-SCDP human activity
None	N	n/a

Table 46. Impact matrix of subproject component type and environmental receptor

Subproject Component Type	Environmental Receptor																	
	Biological			Physical							Social							
	Trees, vegetation & wildlife habitat	Aquatic vegetation & wildlife habitat	Animal & plant specie	Noise or vibration	Dust, NOx, SO_x, odour	Water quality, TSS, oil, grease, BOD, TN, TP, coliform	Soil erosion	Soil quality, oil, gas grease, worker waste	Drainage, local floods	Solid & domestic waste	Fishing & aquaculture	Access	Road traffic, & traffic safety	Boat transportation	Tourism	Cultural heritage	Economy	Resettlement & asset loss compensation
Pre-construction Phase																		
Embankment Developments, Dredging																		M
Parkland Development																		L
Stream-drain Rehabilitation																		N

Subproject Component Type	Environmental Receptor																	
	Biological			Physical							Social							
	Trees, vegetation & wildlife habitat	Aquatic vegetation & wildlife habitat	Animal & plant specie	Noise or vibration	Dust, NOx, SO_x, odour	Water quality, TSS, oil, grease, BOD, TN, TP, coliform	Soil erosion	Soil quality, oil, gas grease, worker waste	Drainage, local floods	Solid & domestic waste	Fishing & aquaculture	Access	Road traffic, & traffic safety	Boat transportation	Tourism	Cultural heritage	Economy	Resettlement & asset loss compensation
New Wastewater Networks & Treatment, and Water Supply																		M
New and Upgraded Roads, Drainage, & Bridges																		H
Construction Phase																		
Embankment Developments, and Dredging	M	H	L	M	M	H	M	L	L	M	M	M	M	M	L	L	L	
Parkland Development	L	L	L	M	M	M	M	L	L	L	M	M	L	L	L	N	L	
Stream-drain Rehabilitation	L	L	L	L	L	M	L	L	M	N	N	L	L	N	N	N	L	
New Wastewater Networks & Treatment, and Water Supply	M	N	N	M	M	L	L	M	M	N	N	M	M	N	L	N	L	
New and Upgraded Roads, Drainage, & Bridges	H	M	M	H	H	M	M	M	M	M	L	H	H	L	L	L	L	
Operation Phase																		
Embankment Developments, Dredging																		
Parkland Development						L							L					
Stream-drain Rehabilitation																		
New Wastewater Networks & Treatment, and Water Supply					M	M							L					

Subproject Component Type	Environmental Receptor																	
	Biological			Physical							Social							
	Trees, vegetation & wildlife habitat	Aquatic vegetation & wildlife habitat	Animal & plant specie	Noise or vibration	Dust, NOx, SO_x, odour	Water quality, TSS, oil, grease, BOD, TN, TP, coliform	Soil erosion	Soil quality, oil, gas grease, worker waste	Drainage, local floods	Solid & domestic waste	Fishing & aquaculture	Access	Road traffic, & traffic safety	Boat transportation	Tourism	Cultural heritage	Economy	Resettlement & asset loss compensation
New and Upgraded Roads, Drainage, & Bridges				M	M								M					

2. Preconstruction Phase (Siting)

a. Resettlement and Compensation

262. The primary impact during the period when the sites and alignments of all subproject components are finalized are the varying levels of resettlement of households, and asset losses, or lost income from disrupted employment or commerce that occurs due either to the location or actions of the components. For asset loss and disrupted income compensation is provided. The details of the Resettlement Plans (RP) and Inventory of Losses (IoL) for each subproject component are reported separately.

263. However, an estimate of potential resettlement and compensation obtained during the January and February 2017 review missions (Table 39) indicates that the road, and wastewater network component types will likely generate the greatest requirement for resettlement. Agriculture and home garden lands will be lost from the footprints of the new parklands in Hue and Vinh Yen with home gardens lost throughout the embankment developments. In Hue the new road and bridge across the Nhu Y River in An Duong, and the upgrades to the Bui Thi Xuan and Huyen Tran Cong Chua roads are expected to generate relatively high resettlement and compensation requirements. The indicative qualitative levels of impact on resettlement and compensation are presented in in the separate Resettlement and Compensation Plans for the three subprojects.

b. Information Disclosure & GRM

264. A key activity during the pre-construction phase is to continue stakeholder involvement with the SCDP which was started with the public consultations summarized above. At this stage of SCDP implementation the IEE and the three subproject EMPs will be available for review by the stakeholders, and the Grievance Redress Mechanism (GRM) for affected persons will be initiated (see chapter VIII). A public consultation and engagement plan is defined in each of the Project city EMPs. The PMU in conjunction with the national staff of the Project Management & Consultant Supervision (PMCS) team will hold ad hoc public meetings to address any broad or cumulative public concerns of a subproject. Contractors will be requested to disclose project information, contact information and the GRM at all construction sites, and to conduct regular meetings with relevant ward authorities and local residents to present the construction schedule,

methods, potential impacts and risks to environment and the community, and the proposed control measures.

c. Update EMPs, Bidding Documents

265. The subproject EMPs need to be updated during the pre-construction detailed design stage to ensure they fully address the potential impacts of the final detailed designs of the subproject components. The environmental staff of the PMCS will update the EMP to meet any changes to the subcomponent designs. Example of common component changes are to the alignments of the new and upgraded roads and bridges, footprints of the parklands, lateral breadth of new or restored embankments, and alignments for new wastewater collection and water supply networks. Updated EMPs will be submitted to ADB for review and clearance, and will be attached to the bidding documents for civil works packages.

d. Protection of Cultural Physical Resources

266. The Citadel and annexed Temples & Tombs of Kings of Hue, which form part of the Complex of Hue Monuments, are the single highest valued national and local cultural and heritage resource potentially affected of the SCDP. Thus, as part of the detailed design of the Hue components, plans to protect the Citadel and annexed Temples & Tombs of Kings of Hue from five components must be developed in conjunction with the Hue Monuments Conservation Centre (HMCC). The key components are all components within 500m of the Citadel and the Tombs, such as dredging & embankment developments of the lakes inside the Citadel, drainage & pavement improvements of streets in the Citadel, dredging and embankment works of the four rivers that surround the Citadel, and road extension and rehabilitation. HMCC shall be consulted by the detailed design consultant to ensure that design and proposed construction methods are fully compliant with the Complex of Hue Monuments Management Plan (2015). All detailed designs will be shared with the HMCC and ADB for review prior to their approved by the provincial PC.

267. **Measures during pre-construction phase.** Based on the above sections, key potential impacts and mitigation measures of the pre-construction phase are:

1) Finalization & initiation of compensation and resettlement plans for affected households and businesses;
2) Completion of detailed designs of the subproject components, including (a) incorporation of climate proofing measures as defined in this IEE (Section VI.F) and (b) involvement of cultural heritage specialists from HMCC and/or external experts, and submission to HMCC and ADB for review and appraisal (for Hue components);
3) Updating and initiating the subproject EMPs, with special reference to the physical cultural resources of Hue. The updated EMP for the Hue Component needs to take special care and measures to protect the heritage resources, and should be submitted to ADB for review and clearance prior to contract bidding; and
4) Preparation of bidding documents, making sure that the updated EMPs are adequately reflected therein.

3. Construction Phase

268. The construction phase will primarily cause short-term disturbances and impacts that can be prevented or mitigated with standard civil works actions. From Table 42 the potential impacts

classed as **H**igh and **M**oderate for each subproject Component Type are elaborated below with specific component-level site issues identified where appropriate.

a. Embankment Developments and Dredging

i. Aquatic wildlife habitat

269. Dredging of lakes and rivers temporarily destroys or significantly disrupts the benthic community of plants and animals because the active upper strata of the physio-chemical habitat and major portions of the community are either transported to a disposal site, or completely disintegrated from the dredging procedure. Damage or disruption of riverine or lacustrine benthic habitats will indirectly impact the fish community which depend on the bottom for food and reproduction.

270. The benthic plant and animal community will recover as long as dredging is not conducted regularly. Moreover, dredging often removes anoxic organic sediments leading to increased water quality (e.g., increased oxygen concentration, reduced sulphur) which can effect the return of a more diverse benthic community, and ultimately fish community.

271. While no data exist for the benthic communities, and limited information exists for fish communities in the rivers and lakes that will be dredged in the three cities, the short-term impacts of dredging would be greatest for the Dam Vac Lake. Dam Vac Lake is much larger, and a natural lake given it receives river inputs and is drained by the Phan River. Dam Vac Lake supports a much larger local fishery and cottage aquaculture. Whereas, the Citadel lakes are being primarily runoff catchment ponds, do not support much of an aquatic community.

272. Similarly, the impact of dredging on the aquatic community of Ke Van River, Lap River, and Hoa River that surround the Citadel in Hue would be minor given these “rivers” are manmade canals established to receive flood water, and wastewater discharge from within the Citadel. The impact of river and lake embankment restoration and development on aquatic communities will be much less than dredging.

Mitigation

273. Effective mitigation measures for the short-term impact of dredging on aquatic habitat are limited. Flowing water silt curtains should be deployed around dredging areas to minimize the extent of disturbance during dredging works. The local fisher communities and shoreline residents should be consulted to determine whether information exists that indicates when fish populations are in the area for feeding or spawning. This would allow dredging operations to be scheduled out of these periods.

274. For the river embankment works vehicles should be kept out of the rivers or lakes. Infilling along shorelines should be avoided or minimized. The river embankment components should place flowing water silt curtains between the embankment works and the open river. Similarly, silt curtains should be placed between the embankment works on Dam Vac Lake and the open lake. The curtains act to contain the suspended sediment caused from excavation and erosion close to shore where it will eventually re-settle to the bottom thereby minimizing exposure of aquatic biota out in open river or lake. Regular water quality monitoring will be conducted during dredging and embankment rehabilitation works to ensure that temporary disruption of the water quality through sediment stir-up is contained within the direct area of work.

ii. Terrestrial habitat

275. The new embankment developments (e.g., Lo River, Nhu Y River, Dam Vac Lake, & Citadel lakes will result in the greatest loss of vegetation including trees compared to the embankment restorations. The estimated areas affected by the subproject are provided in Table 45.

Table 47. The area affected by the project

Lake or River	Directly affected area* (m^2)	Secondary affected** area (m^2)
Hue subproject		
Vuong lake	1,040	1,560
Trac lake	630	945
Sen lake	950	1,425
Xa Tac lake	980	1,470
Ke Van river	17,500	7500
An Hoa river	39,200	15,000
Dong Ba river	11,900	5,100
Lap river	14,000	6,000
An Cuu river	3,500	1,500
Nhu Y river	2,450	1,050
Ha Giang subproject		
Western embankment of Lo river	5,760	2,880
Mien River	18,000	9,000
Me Stream	9,600	4,800
Vinh Yen subproject		
Dam Vac Lake	21,000	10,500

* Directly affected areas estimated by multiplying length of embankment by width of embankment (e.g., sidewalks).
** Secondary areas estimated by multiplying embankment length by an aveage width of 3 m along boundary of component, and also including temporary areas for construction materials and equipment storage, and dredgate.

276. However, as for the affected aquatic habitats in the three subproject areas, none of the affected areas qualify as natural or critical habitat as confirmed by the Departments of Agriculture and Rural Development. Staff from the Provincial Departments of Natural Resources and Environment (DONRE) confirmed that there are no rare and endangered terrestrial wildlife that will be affected by the developed embankments.

277. Removing the existing vegetated embankment surfaces will also remove the natural erosion control function of the embankments. By design of the new embankments must at least duplicate that erosion control, but hopefully improve upon it.

<u>Mitigation</u>

278. As part of the Green City Action Plans, and as proposed for all embankment components, the removal of natural vegetation from embankments should be avoided, or at least minimized. If vegetation is removed for the new or restored embankment, it should be replaced local like-for-like, or with more robust vegetation varieties.

iii. Dredged sediment, infill and excavate

279. The dredging of lakes, rivers and canals for the Hue and Vinh Yen subprojects will generate large volumes bottom sediment. The volumes and quality of dredgate are summarized in Table 46.

Table 48. Total volumes of infill, dredgate, and excavate materials

Component	Dredgate (m^3)	Excavation (m^3)	Filling (m^3)	Total amount (m^3)
Dredging and Embankment of Ke Van River	18,126		26,863	44,989
Dredging and Embankment of An Hoa River	143,344		77,955	221,299
Embankment of Dong Ba River		837	714	1,551
Dredging and Embankment of Lap River	16,308	3,998	15,286	35,592
Rehabilitation and Embankment of Nhu Y River		3,028	3,717	6,745
Rehabilitation and Embankment of An Cuu River		6,017	3,751	9,768
Dredging and Embankment of Lakes within the citadel	166,800		6,778	173,578
Dam Vac lake	864,215			
Total				2,042,971

280. As indicated in the environmental baselines for Hue and Vinh Yen cities (Chapter IV), the quality of the bottom sediment of all surface waters to be dredged is not contaminated with heavy metals and which meet government QCVN soil/sediment quality standards for common common heavy metals. The dredgate will not require pre-treatment before disposal at the infill site for the Green Park at end of Dam Vac lake in Vinh Yen, and at the designated disposal sites in Hue as per Hue Waste Disposal Master Plan. No dredgate will be used as soil for agricultural areas as it does not always meet the QCVN standard for agricultural soil quality. The only issue with dredging as discussed below is the short-term maximum effect on suspended sediment (TSS) and turbidity levels in the affected waters when dredging occurs which will be mitigated as much as possible.

281. As indicated in Chapter III dredging in Hue city will be done with a standard bucket dredge and barge. The dredgate will be temporarily stored on the nearest shore away from human activity or property and allowed to dewater. The dewatered dredgate will be trucked to the nearest approved dump site according the to Hue Municipal Waste Disposal Plan. The need to identify suitable sites approved by the provincial DONRE prior to bidding for works is flagged as loan assurance.

282. However, the dredgate from Dam Vac lake in Vinh Yen, which also is not contaminated for heavy metals, will be used as infill for the new Green Park component which will be constructed at south end of the lake. As explained in Chapter III Dam Vac lake will also be dredged with bucket and barge but from discrete diked cells which will contain suspended sediment to small areas.

283. Excavated soil from any of the subproject component sites that exceeds QCVN soil/sediment quality standard standards[40] will be disposed in DONRE approved sites away from agricultural areas. In Hue, disposal will be conducted in compliance with the Hue Municipal Waste Disposal Plan. The quality of soil from planned excavation sites will be determined as part of the pre-construction phase activities of EMPs.

iv. Water quality

284. A major impact of civil construction works along rivers and lake embankments, and from lake dredging is on surface water quality caused from soil erosion and sedimentation. Suspended sediment levels (TSS) of the affected rivers and the lakes in Hue, Ha Giang and Vinh Yen will reach maximum possible concentrations which can last over long periods of time from the operation of planned barge dredges, and large excavators at the foot of shorelines. Moreover, sedimentation continues when shoreline equipment is not operated because the loose soil at these sites continues to erode into affected water courses.

285. The bucket dredging from barges will cause extensive sedimentation of the Citadel lakes and rivers because this form of dredging acts to re-suspend a large volume of bottom sediment that is not transported away. This occurs because a significant portion of each bucket load washes out of bucket before being emptied on to the barge, and because by design the water content [with some sediment] is washed off the barge to maximize sediment load. However, the proposed plan to only dredge small temporarily bermed cells of Dam Vac Lake in Vinh Yen should contain the sedimentation to small areas allowing the sediment to fall out of suspension before the adjacent cell is dredged.

286. The other common source of surface water pollution is from oil, gas, and grease from the operation [and maintenance] of heavy equipment in, and near surface waters. Fuel tanks can leak, and spent oil and grease can also be discharged in or near the lakes or streams.

Mitigation

287. Silt curtains should be applied to both embankment works and dredging operations. Silt curtains can be placed around a dredging barge to contain suspended sediment. The use of a silt curtain mimics the planned dredging protocol of discrete cell dredging in Dam Vac Lake. Regular water quality monitoring will be conducted during dredging and embankment rehabilitation works to ensure that temporary disruption of the water quality through sediment stir-up is contained within the direct area of work. Contractors will be required to use new fuel tanks, and store all oils and lubricants in on concreate pads away from water courses. The need to identify suitable sites approved by the provincial DONRE prior to bidding for works is flagged as loan assurance.

[40] QCVN 43:2012/BTNMT - National Technical Regulation on Sediment Quality; QCVN 03-MT:2015/BTNMT National technical regulation on the allowable limits of heavy metals in the soils applying for agricultural land; QCCVN 07: 2009/BTNMT: National Technical Regulation on Hazardous Waste Thresholds.

v. Noise and vibration

288. Operation of heavy excavation equipment and barge dredges, pile driving for embankment footings, and movement of large construction vehicles creates noise. The noise will not be an issue in the more remote areas such as on the Mien River and most sections of the Lo River in Ha Giang, and in the middle of Dam Vac Lake in Vinh Yen. However, noise from dredging and riverbank works will be a potential issue in, and adjacent to the Citadel, and on the Nhu Y River in Hue.

289. From EIA, noise levels from operation of construction equipment are calculated with the following equation:

$$Lp(X) = Lp(X_0) + 20 \log10(X_0/X)$$

In which:

- $Lp(X_0)$: Noise level at a distance of 15 m from the source (dBA)
- Lp(X): Noise level at the calculated location
- X: calculated location
- X_0 = 15m

290. Estimated noise levels from the main construction equipment for dredging and riverbank works are shown in Table 47. Construction contractors will be required to provide workers with PPE for noise.

Table 49. Construction equipment noise emission levels

TT	Equipment/Machine	Noise levels and impact ranges (dBA)							
		15m (*)	**25m**	**30m**	**45m**	**60m**	**90m**	**120m**	**150m**
1	Truck	**88**	**84**	**82**	**78**	**76**	**72**	70	68
2	Concrete Mixer	**85**	**81**	**79**	**75**	**73**	69	67	65
3	Concrete Pump	**82**	**78**	**76**	**72**	70	66	64	62
4	Backhoe	**80**	**76**	**74**	70	68	64	62	60
5	Pile driver	**101**	**97**	**95**	**91**	**89**	**85**	**83**	**81**
QCVN 26:2010/BTNMT		70 dBA (day time)							
WHO Noise standard		Commercial and Industrial: 70 dB(A) (daytime) Residential, institutional, & educational: 55 dB(A) (daytime)							

(*): US Environment Protection Agency "Noise from Construction equipment and Operation, Building Equipment and Home Appliances" NTID 300.1, December 31, 1971.

291. Table 43 suggests residents within 60-90 m surrounding the construction sites of dredging and riverbank works could become annoyed by noise generated from construction activities. Pile driving could create noise exceeding the QCVN standard to a distance of 150 m, and significantly more if the WHO standard for noise at sensitive sites is applied.

292. Vibration should not be an impact in all three cities because blasting or pile driving have not been identified as being needed for the embankment works. Vibration for heavy equipment or truck operation will not be significant.

Mitigation

293. The operation of heavy vehicles for the embankment works and dredging operations should be scheduled during the hours of 07:00 and 17:00. All heavy equipment should be kept in good working order. Noise monitoring will be conducted regularly at sensitive sites to ensure that noise levels are contained within the WHO standard of 55dB(A) during daytime. Temporary noise barriers shall be used in case noise levels exceed the standard value.

vi. Dust and air pollution

294. The operation of heavy equipment, trucks, and dredge barges will emit SOx, NOx, and CO_2. The local levels of these gases can be high depending on how well equipment is maintained in proposer working condition, and if uncontrolled vehicle idling is allowed. In addition to air pollution, exhaust from heavy equipment can become a significant nuisance to local residents.

295. The operation of heavy trucks along dedicated new construction roads, or along existing roads to the embankment sites will create dust. The dust levels can be significant depending on the amount of sand and small aggregate is transported along the roads, and how much mud and sand accumulates on the roads that is spread from the tires of the construction vehicles.

296. Dust will pose a big problem for residents alongside the embankment areas or construction access roads because all surfaces outside and inside the homestead become dust covered from truck traffic. Dust generated from the embankment sites will be restricted to dust from excavations, fugitive dust from truck transport, and wind erosion from aggregate piles and storage. Dredging of the Citadel lakes and rivers in Hue, and in Dam Vac lake, the Citadel, and rivers will create dust if the dredgate is allowed to become completely dry before transport to the disposal sites.

297. The dredging and embankment components of the Hue subproject are chosen to estimate dust levels and exhausted gases emitted during construction phase of subproject given the diversity of activities associated with dredging, embankment development, and sidewalk/promenade construction. Table 48 provides dust emission coefficients for construction activities based on demand for fuel, volume of transport material, and means of transport.

Table 50. Coefficient of dust emission from construction

Unit: g/m³

No	Pollution sources	Coefficient
1	Dust from excavation, leveling and filling blown by wind	1 - 100
2	Dust from construction material loading and storage (soil, aggregate…)	0,1 - 1
3	Dust from construction material transportation	0,1 - 1

Source: World Health Organization, 1993

298. From the FS report the estimated total volumes of material used for infilling, removed from excavation, and from dredging for the Embankment and Dredging components in Hue are summarized in Table 46. Assuming a construction period up to 12-18 months for the components and the length of embankments and sections to be dredged, the estimated dust and dust levels

generated from the construction phase of these components from the EIA are calculated accordingly by multiplying the coefficient in Table 48 with the dredging and excavation volume in Table 46 and summarized in Table 49.

Table 51. Load of dust emission from constrution activities

No	Components	Volume (kg)		Length	Duration	Load of Dust Emission (E) (mg/m/s)	
		Max	Min	km	Months	Min	Max
1	Dredging and Embankment of Ke Van River	44,989	4,498	2.57	6	1.12	0.11
2	Dredging and Embankment of An Hoa River	221,299	22,129	5.49	12	1.29	0.12
3	Embankment of Dong Ba River	1,551	155	1.65	6	0.06	0.01
4	Dredging and Embankment of Lap River	35,592	3,559	2.12	6	1.08	0.11
5	Rehabilitation and Embankment of Nhu Y River	6,745	674	0.81	6	0.53	0.05
6	Rehabilitation and Embankment of An Cuu River	9,768	976	0.57	6	1.09	0.11
7	Dredging and Embankment of Lakes within the citadel	173,578	17,357	1.0	6	11.16	1.12

299. Based on dust emission in Table 46 and the Sutton equation, the dust dispersion is calculated as follow:

$$C = \frac{0{,}8E.\left\{\exp\left[\frac{-(z+h)^2}{2\sigma_z^2}\right] + \exp\left[\frac{-(z-h)^2}{2\sigma_z^2}\right]\right\}}{\sigma_z.u} \quad (mg/m^3)$$

In which:

- *C: Dust/Air pollutant concentration (mg/m^3);*
- *E: Load of dust/air pollutant (mg/m/s);*
- *z: the height of the calculated spot (m) (z=1,0m-5,0);*
- *h: the height of construction work comparing with sourrouding areas (m) (h=0,5m);*
- *u: wind velocity in average (m/s) (u=2,2 m/s);*
- *σ_z: diffusion coefficient by z axis (m)* ***$\sigma_z = 0{,}53x^{0,73}$ (m)*** *(x: distance to the pollution source by wind direction)*

300. The prediction of dust dispersion is presented in Table 50.

Table 52. Dust dispersion (mg/m^3) for river embankment and dredging in Hue city

Distance to the pollution source x (m)	z (m)				
	1	**2**	**3**	**4**	**5**
5	**1.19**	**0.75**	**0.34**	0.11	0.03
10	**0.81**	**0.68**	**0.50**	**0.33**	0.19
20	**0.51**	**0.48**	**0.43**	**0.37**	0.30
25	**0.44**	**0.42**	**0.39**	**0.35**	0.30
50	0.27	0.26	0.26	0.25	0.23
100	0.16	0.16	0.16	0.16	0.15
QCVN 05:2013/BTNMT (in an hour)	0.30 (mg/m^3)				

301. Thus, the dust levels arising from the embankment and dredging activities (without mitigation measures) at the spots within the areas having x of 5, 10, 20 and 25 m and z of 1-3 m are predicted to exceed the standard QCVN 05: 2013 / BTNMT: National Technical Regulation on ambient air quality. However, these estimated normal dust levels at construction sites will be mitigated where possible with such measures as timing, application of wetting agents and aggregate covers, and tall site barriers as per EMP.

Mitigation

302. Embankments that need vegegation clearance should be wetted or covered during construction works, and re-vegetated as soon as possible. Dredged sediment storage and disposal sites should be covered. Wetting agents should be applied regularly to all construction roads. Tucks carrying aggregate should always be covered. All construction vehicles should be kept in good working order. Air quality monitoring, especially dust levels, will be conducted regularly to confirm compliance with the QCVN 05: 2013 / BTNMT.

vii. Solid and domestic waste

303. The embankment works and to a lesser degree the dredging operations will generate solid waste and domestic waste from workers, and from discarded construction materials. Work camps, whether temporary or long term, provide places to eat and sleep for workers. Camps provide pit latrines and supplies of potable water for cooking and bathing. Domestic liquid and solid waste can become a local problem depending on the size of the camp, and compliance with formal waste management procedures.

304. The embankment components in Hue, Ha Giang and Vinh Yen will produce construction material waste in the form of unused and discarded aggregate, concrete, asphalt, wood forming material, reinforcing bar, and sheet steel for piling. Waste from dredging operations should be less.

Mitigation

305. A formal waste collection and disposal program should be instated at all embankment sites and for all dredging operations. All waste construction material must be contained and stored on site and removed from site daily or weekly. Worker living areas must be provided with adequate garbage bins, and garbage collected and transported to local landfill regularly. Pit latrine areas must be kept clean, and buried when camp closed.

viii. Reduced road access, increased traffic, and risk of traffic accidents

306. Construction activities on or adjacent existing roadways, or roadways that are used by construction vehicles to access the embankment sites will act to block normal local traffic thereby reducing access. This will be particularly prevalent in the urban core areas where traffic density is highest. Thus, access and movement of residents and tourists in and around the Citadel in Hue will be affected the most by the embankments works compared to the less dense areas of the embankments works in Ha Giang and around Dam Vac Lake in Vinh Yen.

307. The increased construction vehicle traffic that will occur with the embankment works, and along routes to sediment disposal sites will affect normal traffic patterns and volumes. Along with the increase in large truck traffic will be an increase in the risk of traffic accidents.

Mitigation

308. A traffic management plan must be put in place for local and construction traffic near the embankment component sites. Enforced speed limits must be well posted, and additional traffic direction signs to assist both construction and local traffic should be posted outside and inside construction zones and along construction truck routes. The traffic management plan shall be developed by the works contractors as part of their construction environmental management plan (CEMP), and be submitted to local (provincial and city) traffic control authorities for approval.

ix. River/lake transportation & fishing/aquaculture

309. Dredging primarily, and the embankment works secondarily will interfere with boat traffic in the affected rivers and lakes. Similar, to road traffic the greatest impact will occur in the rivers in Hue in particular in the rivers (canals) adjacent to the Citadel due to the higher urban density and associated greater commercial and private boat traffic. Dam Vac Lake will be more affected than the lakes of the Citadel due to the greater activity level on Dam Vac Lake. However, given the very shallow water levels in Dam Vac Lake due to excessive bottom sediment accumulation, the lake is currently only navigable by small barges and boats.

310. Dredging, and embankment works will also potentially affect fishing and aquaculture activities especially if these components occur in fishing and aquaculture zones (Table 51). zones. For example, net fishing and aquaculture that is ongoing in the Nhu Y River in Hue is located where the new road and bridge will cross the river in An Duong. Similarly, fishing activities on Dam Vac Lake will be potentially affected in the short term.

Table 53. Fishing and aquaculture zones affected by the subprojects

Affected waterbody	Delineated fishing and aquaculture zones
Hue subproject	
Vuong lake	None
Trac lake	None
Sen lake	single household (aquaculture)
Xa Tac lake	none
Ke Van river	none
An Hoa river	none
Dong Ba river	none
Lap river	none
An Cuu river	none
Nhu Y river	100 households doing commercial aquaculture along section of embankment to be developed. (Group 13B of Vi Da ward)
Ha Giang subproject	
Western embankment of Lo river	few fishers Phu Linh commune fish along section,
Mien River	none
Me Stream	none
Vinh Yen subproject	
Dam Vac Lake	Households from Vinh Quang hamlet of Thanh Tru commune fish the lake

Mitigation

311. Shoreline signage should be placed above and below dredging and embankment areas, and community information leaflets should be distributed to warn and educate users of the water bodies of the component activities. The user community should be consulted so that dredging and embankment activities can be scheduled to avoid user activities on the affected rivers and lakes. The PMUs, with support from the EAs, will be responsible to inform all users of the affected waterbodies of the types and schdules of activities that could disrupt uses of the surfaces waters. As part of the detailed Inventory of Losses and LARP, fishers will be compensated for any permanent or temporary loss of fishing income caused by the subprojects.
lakes.

b. Parkland Development

i. Noise and vibration

312. Operation of heavy dump and grading equipment, pile driving for infilling footings, and movement of large construction vehicles creates noise. The noise will be more of an issue in Vinh

Yen centre than at the site for the Business Centre in southeast Vinh Yen and the peri-urban An Duong area south of Hue.

313. Similarly to Embankment and Dredging components, the estimated noise emission levels from construction equipment/machine of Parkland components are provided in Table 52.

Table 54. Construction equipment noise emission levels

TT	Equipment/Machine	Noise levels and impact ranges (dBA)							
		15m (*)	25m	30m	45m	60m	90m	120m	150m
1	Truck	**88**	**84**	**82**	**78**	**76**	**72**	70	68
2	Dozer	**85**	**81**	**79**	**75**	**73**	69	67	65
3	Compactor	**82**	**78**	**76**	**72**	70	66	64	62
4	Backhoe	**80**	**76**	**74**	70	68	64	62	60
QCVN 26:2010/BTNMT		70 dB(A)							
WHO Noise Limits		Commercial and Industrial: 70 dB(A) (daytime) Residential, institutional, & educational: 55 dB(A) (daytime)							

(*): US Environment Protection Agency "Noise from Construction equipment and Operation, Building Equipment and Home Appliances" NTID 300.1, December 31, 1971.

314. The data in Table 48 suggest residents within 150-200 m surrounding the construction sites of dredging and river bank works could be annoyed by noise generated from construction activities.

315. Vibration should not be an impact in the three cities because no blasting has been identified as an activity needed for the parkland developments. Vibration from heavy equipment or truck operation will not be significant.

Mitigation

316. The operation of heavy vehicles and equipment should be scheduled during the hours of 07:00 and 18:00. All heavy equipment should be kept in good working order. Noise monitoring will be conducted regularly at sensitive sites to ensure that noise levels are contained within the WHO standard of 55-70 dB(A) during daytime. Temporary noise barriers shall be used in case noise levels exceed the standard value.

ii. Dust and air pollution

317. The operation of heavy equipment, trucks will emit SOx, NOx, and CO_2. The local levels of these gases can be high depending on how well equipment is maintained in proposer working condition, and if uncontrolled vehicle idling is allowed. In addition to air pollution, exhaust from heavy equipment can become a significant nuisance to local residents.

318. The operation of heavy trucks along dedicated existing or new construction roads to the park sites will create dust. The dust levels can be significant depending on the amount of sand

and small aggregate transported along the roads, and how much mud and sand accumulates on the roads that is spread from the tires of the construction vehicles.

319. The Green Park development south of Dam Vac Lake of Vinh Yen City is chosen to calculate quantitative amount of dust levels and exhausted gases during construction phase in view of its large scope compared to the other Parkland components. Table 53 shows the amount of infilling and excavation materials of the Green Park component.

Table 55. Total volume of infill and excavate for Green Park

Construction Items	Excavation material (m^3)	Filling material (m^3)	Total volume of excavation and filling material (m^3)
Inner roads	6,995	99,643	106,638
Leveling	1,024,796	51,502	1,076,298
Drainage	70,111	8,688	78,799
Sewer	1,372	1,425	2,797
Lake embamkment	439,084	113,312	552,396
Total	**1,542,358**	**274,570**	**1,816,928**

(Source: FS report for Vinh Yen City)

320. Based on the total volume and the coefficient in Table 48, construction time (12-24 months); the length of calculated sections in average is 1,000m and the load of dust emission is calculated in Table 54.

Table 56. Load of dust emission from constrution activities

TT	Construction items	Volume (kg)		Length	Time	Load of Dust Emission (E) (mg/m/s)	
		Min	Max	m	months	Min	Max
1	Inner roads	106,638	1,066	1000	24	0.0020	0.1978
2	Leveling	1,076,298	107,629	1000	24	0.0200	1.9963
3	Drainage	78,799	7,879	1000	12	0.0029	0.2923
4	Sewer	2,797	279	1000	12	0.0001	0.0104
5	Lake embamkment	552,396	55,239	1000	12	0.0205	2.0492

321. The amount of oil consumed by construction equipment/machine as shown in Table 55 is estimated according to the number of equipment/machine mobilized for the component and the standard rate of consumtion for oil in Circular No. 06 / 2010 dated 26/5/2010 method to determine machine shift price.

Table 57. Estimated volume of oil consumed by the component

Consumed oil (lít)	Consumed oil (tấn)
566,610	471.42

(a liter of diesel =0,832 kg)

322. The loads of air pollutants (Table 56) generated by construction and transportation are calculated based on the coefficients of pollution established by US EPA and WHO for operation of trucks more than 16 tons which is indicated that a truck 16-ton emits SO_2 =7,43xS kg/km (S=0.5%), NO_2=24,1 kg/km; CO=3,7 kg/km.

Table 58. Estimate loads of air pollutants from construction equipment

Total volume of air pollutant generated by the component (kg)			Calculated leghth	Construction time (month)	The loads of air pollutant (mg/m/s)		
CO_2	SO_2	NO_2			CO_2	SO_2	NO_2
13,199	18,856	25,928	1,000	24	0.2448	0.3498	0.4809

323. Dust and air polutant dispersion is identified following the said Sutton equation above. The results are presented in following tables.

Table 59. The dispersion of CO concentration (mg/m^3) from construction equipment

Distance x (m)	z (m)				
	1	2	3	4	5
5	0.09	0.05	0.02	0.01	0.00
10	0.06	0.05	0.04	0.02	0.01
20	0.04	0.03	0.03	0.03	0.02
25	0.03	0.03	0.03	0.02	0.02
50	0.02	0.02	0.02	0.02	0.02
100	0.01	0.01	0.01	0.01	0.01
QCVN 05:2013/BTNMT (in an hour)	**30** mg/m^3				

Table 60. The dispersion of SO_2 concentration (mg/m^3) from construction equipment

Distance x (m)	z (m)				
	1	2	3	4	5
5	0.12	0.08	0.03	0.01	0.00
10	0.08	0.07	0.05	0.03	0.02
20	0.05	0.05	0.04	0.04	0.03
25	0.04	0.04	0.04	0.04	0.03
50	0.03	0.03	0.03	0.03	0.02
100	0.02	0.02	0.02	0.02	0.02
QCVN 05:2013/BTNMT (in an hour)	**0.350** mg/m^3				

Table 61. The dispersion of NO_2 (mg/m^3) concentration from construction equipment

Distance x (m)	z (m)				
	1	2	3	4	5
5	0.17	0.10	0.05	0.02	0.00
10	0.11	0.10	0.07	0.05	0.03
20	0.07	0.07	0.06	0.05	0.04
25	0.06	0.06	0.05	0.05	0.04

Distance x (m)	z (m)				
	1	**2**	**3**	**4**	**5**
50	0.04	0.04	0.04	0.03	0.03
100	0.02	0.02	0.02	0.02	0.02
QCVN 05:2013/BTNMT (in an hour)	**0.20** mg/m^3				

324. Comparing with the standard QCVN 05: 2013 shows that exhaust emissions from construction equipment/machine for the component “Green Park Development South of Dam Vac Lake” are lower than the allowable standards and thus will not cause a significant impact on ambient air quality.

Mitigation

325. Wetting agents should be applied regularly to all construction roads. Aggregate piles should trucks carrying aggregate should always be covered. All construction vehicles should be kept in good working order.

iii. Solid and domestic waste

326. The construction of the parklands will generate solid waste and domestic waste from workers, and from discarded construction materials. The temporary work camps whether provide places to eat and sleep for workers. Camps provide pit latrines and supplies of potable water for cooking and bathing. Domestic liquid and solid waste can become a local problem depending on the size of the camp, and compliance with formal waste management procedures. The parkland developments in Vinh Yen and Hue will produce construction material waste in the form of unused and discarded aggregate, concrete, asphalt, wood forming material, reinforcing bar, and sheet steel for piling.

Mitigation

327. A formal waste collection and disposal program should be instated at the parkland and business centre in Vinh Yen, and the park site in Hue. All waste construction material must be contained and stored on site, and removed from site daily or weekly. Worker living areas must be provided with adequate garbage bins, and garbage collected and transported to local landfill regularly. Pit latrine or other sanitation areas must be kept clean, and buried when camp closed

iv. Water quality

328. Without mitigation measures, the development of the infilled parkland at the end of Dam Vac Lake will create TSS problems in the lake. The other possible source of surface water pollution is from oil, gas, and grease from the operation [and maintenance] of heavy equipment in, and near the lake. Fuel tanks can leak, and spent oil and grease can also be discharged in or near the lakes or streams.

Mitigation

329. A silt curtain should be suspended along the south shore of Dam Vac Lake to separate the parkland development from the lake. Construction equipment should not be operated, parked, or maintained beside the lake. Contractors will be required to use new fuel tanks, and store all oils and lubricants in on concreate pads away (100m) from water courses.

v. River/lake transportation & fishing/aquaculture

330. Along with the dredging component, the construction of the infilled parkland will initially disrupt local boat movement, and fishing aquaculture activities at the south end of Dam Vac Lake.

Mitigation

331. Shoreline signage identifying the project should be placed around the parkland site, and community information leaflets should be distributed to warn and educate users of the water bodies of the component activities. The user community should be consulted so parkland construction activities can be scheduled to avoid user activities on the lake.

vi. Reduced road access, increased traffic, and risk of traffic accidents

332. Traffic on the roads to the parkland areas in Hue and Vinh Yen will increase with the arrival of construction vehicles. Road access to the area will likely become reduced, and the risk of traffic accidents will increase. The increased traffic and risk of traffic accidents caused by construction vehicles transporting materials will also occur along construction routes.

Mitigation

333. A traffic management plan must be put in place for local and construction traffic near the parkland sites. Enforced speed limits must be well posted, and additional traffic direction signs to assist both construction and local traffic should be posted outside and inside construction zones and along construction truck routes. The traffic management plan shall be developed by the works contractors as part of their construction environmental management plan (CEMP), and be submitted to local (provincial and city) traffic control authorities for approval.

c. Stream-drain Rehabilitation

i. Water quality

334. The drainage works in Ha Giang will degrade water quality in the mountain stream drains from primarily increases in suspended sediment (TSS). Construction waste material and worker domestic waste can also enter the streams. The other common source of surface water pollution is from oil, gas, and grease from the operation [and maintenance] of heavy equipment in, and near surface waters. Fuel tanks can leak, and spent oil and grease can also be discharged in the lakes.

Mitigation

335. All construction equipment should be stored and maintained away from the stream drains. Construction, and worker waste should be managed with regular collection and offsite disposal.

ii. Reduced road access, increased traffic, and risk of traffic accidents

336. Traffic on the urban roads to the three locations of stream drains in Ha Giang will increase with the arrival of construction vehicles. Road access to the areas will likely become reduced, and the risk of traffic accidents will increase. The increased traffic and risk of traffic accidents caused by construction vehicles will also occur along routes to borrow pits and quarries.

Mitigation

337. A traffic management plan must be put in place for local and construction traffic near the three stream drainage sites. Enforced speed limits must be well posted, and additional traffic direction signs to assist both construction and local traffic should be posted outside and inside construction zones and along construction truck routes. The traffic management plan shall be developed by the works contractors as part of their construction environmental management plan (CEMP), and be submitted to local (provincial and city) traffic control authorities for approval.

d. New Wastewater Treatment Networks & Treatment, Water Supply

i. Terrestrial wildlife habitat

338. The alignment for the 30 km new water supply line from the Industrial Park to the villages south of Hue will follow the existing roadway but will potentially require cutting of trees along the existing RoW. Much of the existing road to the villages traverses Production Forest comprised of Acacia and Eucalyptus species. Removing the trees and vegetation will also remove wildlife habitat, which is not critical for reproduction or feeding of rare or endangered species. The Department of Agricutlure and Rural Development (DARD) confirmed that all forests within the alignment are production forests with no protected trees. Nonetheless a significant area of habitat could be destroyed if not properly planned in order to clear the narrow alignment for the pipeline.

339. Similarly, the alignments for the new sewer line and drainage ditch network in Vinh Yen out to the new wastewater treatment plant (WWTP) should be selected carefully to minimize tree cutting. Pursuant to the GCAP for the city, tree preservation is key to the plan. The site of the WWTP does not support trees, only rice paddy which is addressed by the IoL of the RP.

Mitigation

340. The RoWs of the 30 km roadways south to the villages should be reviewed to determine the route for the pipeline that minimizes tree cutting. Short-term traffic disruption from placing the pipeline in the cleared shoulder of the road should be favoured over placing the pipeline at, or just outside the ROW thereby requiring heavy tree cutting.

ii. Noise and vibration

341. The operation of excavation equipment, placement and joining pipeline, and the movement of large construction vehicles will create noise disturbance. However, the installation of sewers and water supply pipes is a linear activity with very short-term interferences and nuisances. The installation of the water supply pipe will occur along a very sparcely populated

road. The construction of the WWTP will generate noise from excavation works, construction of concrete forms for the many treatment lagoons, and from construction traffic.

342. Vibration will not be an issue because no blasting will be needed for the networks or WWTP. Vibration from heavy equipment or truck operation should not be significant.

Mitigation

343. The operation of heavy equipment and vehicles should be scheduled during the hours of 07:00 and 18:00. All heavy equipment should be kept in good working order. Noise monitoring will be conducted regularly at sensitive sites to ensure that noise levels are contained within the WHO standard of 55-70 dB(A) during daytime. Temporary noise barriers shall be used in case noise levels exceed the standard value.

iii. Dust and air pollution

344. The operation of heavy equipment and trucks will emit SOx, NOx, and CO_2. The local levels of these gases can be high depending on how well equipment is maintained in proposer working condition, and if uncontrolled vehicle idling is allowed. In addition to air pollution, exhaust from heavy equipment can become a significant nuisance to local residents.

345. The operation of heavy trucks along construction roads, or along existing roads to network and WWTP sites will create dust. Similarly truck traffic down the roads along which the water pipeline will be laid will also generate dust. The dust levels can be significant depending on the amount of sand and small aggregate is transported along the roads, and how much mud and sand accumulates on the roads that is spread from the tires of the construction vehicles. Dust will become the biggest problem for residents living alongside the wastewater collection network or construction roads.

346. For the purpose of this IEE, the Collection and Wastewater Treatment Component in Three Wards of Dong Tam, Hoi Hop and Tich Son of Vinh Yen City is chosen to calculate quantitative amount of dust levels and exhausted gases during construction phase in view of its big scope of work comparing with other drainage and sewer components of other cities, and its proximity to sensitive receptors (residential areas). The characteristics of the dust and exhausted gases generated by construction activities is dispersed and discontinuous. Based on the total volume and the coefficient in Table 48, construction time (12 months), and the length of collection system, the load of dust emission is estimated in Table 60.

Table 62. Load of dust emission from construction activities

Items	Volume of infill and excavate (kg)	Volume of dust (kg)		Length	Duration	Load of Dust Emission (E) (mg/m/s)	
		Min	Max	m	Months	Min	Max
Collection system	42,610	43	4,261	20,264	12	0.0001	0.0078
Wastewater Treatment Plan	105,269	105	10,527	1,760	12	0.0011	0.2219

347. Following the Sutton equation, the dispersion of dust from filling and excavation activities of the component is presented in Tables 61 and 62 which indicate filling and excavation activities of the component is acceptable in regards to the standard QCVN 05:2013/BTNMT.

Table 63. The dispersion of dust (mg/m^3) from construction of collection system

Distance x (m)	z (m)				
	1.0	2.0	3.0	4.0	5.0
5	0.0271	0.0170	0.0078	0.0026	0.0006
10	0.0185	0.0154	0.0115	0.0075	0.0044
20	0.0117	0.0109	0.0098	0.0084	0.0069
25	0.0100	0.0095	0.0088	0.0079	0.0068
50	0.0061	0.0060	0.0058	0.0056	0.0053
100	0.0037	0.0037	0.0036	0.0036	0.0035
QCVN 05:2013/BTNMT (in an hour)	**0.300 (mg/m^3)**				

Table 64. The dispersion of dust (mg/m^3) from construction of WWTP

Distance x (m)	z (m)				
	1.0	2.0	3.0	4.0	5.0
5	0.077152	0.048358	0.022144	0.007384	0.001787
10	0.052585	0.043946	0.032584	0.021433	0.012505
20	0.033244	0.031104	0.027839	0.023835	0.019521
25	0.028465	0.027125	0.025032	0.022369	0.019358
50	0.017382	0.017079	0.016585	0.015917	0.015098
100	0.010529	0.010462	0.010350	0.010197	0.010002
QCVN 05:2013/BTNMT (in an hour)	**0.300 (mg/m^3)**				

348. Air pollutants from construction activity are emitted as a result of the combustion of fuels as oil, gasoline, petrol used by construction equipment/machine. According to the FS, the volume of fuels estimated to be used for this component is about 26 tons, this volume is minor and eshauted air emissions are not anticipated to affect local ambient air quality.

Mitigation

349. Wetting agents should be applied regularly to all construction roads. Aggregate piles should trucks carrying aggregate should always be covered. All construction vehicles should be kept in good working order.

iv. Solid and domestic waste

350. The construction of the water pipeline, wastewater collection network, and the new WWTP will generate solid waste and domestic waste from workers, and from discarded construction materials. Work camps whether temporary or long term provide places to eat and sleep for

workers. Camps provide pit latrines and supplies of potable water for cooking and bathing. Domestic liquid and solid waste can become a local problem depending on the size of the camp, and compliance with formal waste management procedures.

351. The construction of the new WWTP southwest of Vinh Yen will produce construction material waste in the form of unused and discarded aggregate, concrete, asphalt, wood forming material, reinforcing bar, and sheet steel for piling. Waste from dredging operations should be less.

Mitigation

352. A formal waste collection and disposal program should be put in place for the wastewater network and WWTP component, and water supply component. All waste construction material must be stored and removed from site daily or weekly. Worker living areas must be provided with adequate garbage bins, and garbage collected and transported to local landfill regularly. Pit latrine areas must be kept clean, and buried when camp closed.

v. Drainage and local flooding

353. The construction of the water supply line, wastewater networks and WWTP can produce local drainage issues which can lead to flooding of road sections and lands adjacent to homesteads. The temporary ponding and flooding arises when natural drainage is disrupted from excavation works, and aggregate piling, or excavated cavities are left for long periods of time. This situation is very common when construction is conducted during rainy periods, and when breaks in construction operations occur due to heavy rains.

Mitigation

354. Care must be taken to not create and leave piles of excavated fill for extended periods which interrupt natural slope drainage. Open excavations should be left only if absolutely necessary. When natural drainage must be blocked, temporary channels should be cut laterally to allow natural runoff process to occur.

vi. Reduced road access, increased traffic, and risk of traffic accidents

355. Water pipeline construction activities on the roadways out to the villages south of Hue will create traffic issues and impaired local access. As a result the risk of traffic accidents will increase. Similarly, construction vehicle movement along the wastewater networks and out to the site for the new WWTP will create traffic congestion and increase risk of traffic accidents. The construction traffic along the water supply line roads out to the villages likely will not be as much of an issue because of the relative remoteness of those roads. The traffic issue includes traffic along the routes to the borrow pits or spoil disposal sites as needed.

Mitigation

356. A traffic management plan must be put in place for local and construction traffic near the embankment component sites. Enforced speed limits must be well posted, and additional traffic direction signs to assist both construction and local traffic should be posted outside and inside construction zones and along construction truck routes. The traffic management plan shall be

developed by the works contractors as part of their construction environmental management plan (CEMP), and be submitted to local (provincial and city) traffic control authorities for approval.

e. New & Upgraded Roads, Drainage, and Bridges

i. Terrestrial wildlife habitat

357. The construction of new roads and the upgrades of new roads will require some forest and tree cutting in all three subproject cities. The loss of forest and trees will translate to a loss of terrestrial habitat. As indicated for the water supply component in Hue only production and scrub forests will be cut which do not provide critical habitat for rare or endangered species. This was confirmed by all DARDs consulted. The loss of vegetation along the new RoWs will in the short-term cause erosion issues until the area is either actively or naturally re-vegetated. The natural effect of vegetated ground of moderating runoff will be lost temporarily.

Mitigation

358. As part of the Green City Action Plans, and as proposed for most of the new and updated alignments, removal of natural vegetation should be minimized as much as possible. If vegetation is removed for the new or upgrades roads, it should be replaced local like-for- like, or with more robust vegetation varieties.

ii. Aquatic wildlife habitat

359. The new and upgraded road alignments in all three cities that occur beside rivers and lakes will negatively affect nearshore aquatic habitat from soil erosion and sedimentation without mitigation measures. Moreover, the new and upgraded bridges across the Nhu Y river and the upgraded bridge of Huyen Trang Cong road in Hue, and the new bridge across the Lo River in Ha Giang will temporary affect aquatic habitat from placement of bridge piles, columns, and shoreline concrete anchors.

Mitigation

360. At detailed design the primary mitigation is to finalize designs of new bridges, and bridge upgrades to span the rivers without the need to install in-river support columns. Shoreline works should be minimized to minimize soil erosion. Temporary berms should be constructed along the stream bank to catch and prevent soil from entering the river courses. If possible shoreline works should be scheduled to avoid the periods when fishermen are in area which are good indications of when fish are in the areas.

iii. Noise and vibration

361. Road construction creates noise from the operation of heavy equipment on site and along the roadways, and from the use of jack hammers, and pile drivers. Vibration is not expected to be a significant issue because blasting has not been identified for any of the road components. However, vibration from truck loads of aggregate, or heavy equipment could be an issue in the denser urban areas such as the Citadel.

362. Similarly to above section, the noise emission levels from construction equipment and machinery of Parkland components are presented in Table 63.

Table 65. Construction equipment noise emission levels

TT	Equipment/Machine	Noise levels and impact ranges (dBA)							
		15m (*)	25m	30m	45m	60m	90m	120m	150m
1	Truck	**88**	**84**	**82**	**78**	**76**	**72**	70	68
2	Dozer	**85**	**81**	**79**	**75**	**73**	69	67	65
3	Compactor	**82**	**78**	**76**	**72**	70	66	64	62
4	Backhoe	**80**	**76**	**74**	70	68	64	62	60
5	Concrete Mixer	**85**	**81**	**79**	**75**	**73**	69	67	65
6	Concrete Vibration	**76**	**72**	70	66	64	60	58	56
7	Grader	**85**	**81**	**79**	**75**	**73**	69	67	65
8	Paver	**89**	**85**	**83**	**79**	**77**	**73**	**71**	69
9	Loader	**85**	**81**	**79**	**75**	**73**	69	67	65
10	Generator	**81**	**77**	**75**	**71**	69	65	63	61
11	Pump	**76**	**72**	70	66	64	60	58	56
QCVN 26:2010/BTNMT		70 dB(A)							
WHO Noise Guideline		Commercial and Industrial: 70 dB(A) (daytime) Residential, institutional, & educational: 55 dB(A) (daytime)							

(*): US Environment Protection Agency "Noise from Construction equipment and Operation, Building Equipment and Home Appliances" NTID 300.1, December 31, 1971.

363. During road construction, two or more heavy equipment or machines are likely to be used at the same time. Thus the combination of noise from several pieces of equipment operating during the same time period is calculated accordingly the following equation:

$$L_{\sum} = 10 \lg \sum_{i}^{n} 10^{0,1.Li}$$

In which:

- L_{Σ} : The combination of noise from several pieces of equipment
- Li : Noise level of each piece of equipment
- N : Number of noise sources

364. The result of the combination of noise from construction of the component is presented in Table 64.

Table 66. Combined noise from construction of "Infrastructure of University Area"

No	Equipment/Machine	Noise levels (dBA)							
		15m	25m	30m	45m	60m	90m	120m	150m
1	Combination of noise during filling and excavation (Truck, dozer, compactor, grader..)	**99.5**	**95**	**93**	**90**	**87**	**84**	**81**	**80**
2	Combination of noise during pavement and construction drainage (Truck, Paver, Pump, Generator, Concrete Mixer...)	**89**	**84**	**82**	**78**	**76**	**72**	70	68

365. Given by the noise levels in the table, residential areas within 150 m surrounding the construction sites of road construction works could be affected by noise generated from construction activities.

Mitigation

366. The operation of heavy vehicles, and pile driving activities should be scheduled during the hours of 07:00 and 17:00. All heavy equipment should be kept in good working order. Construction truck traffic along roadways should not occur after 19:00 and before 06:00. Noise monitoring will be conducted regularly at sensitive sites to ensure that noise levels are contained within the WHO standard of 55 dB(A) during daytime. Temporary noise barriers shall be used in case noise levels exceed the standard value. Contractors will be required to provide workers with PPE for noise.

iv. Dust and air pollution

367. The operation of heavy equipment, and trucks emit SOx, NOx, and CO_2. The local levels of these gases can be high depending on how well equipment is maintained in proper working condition, and if uncontrolled vehicle idling is allowed. In addition to air pollution, exhaust from heavy equipment can become a significant nuisance to local residents.

368. The operation of heavy trucks along dedicated new construction roads, or along existing roads to the embankment sites will create dust. The dust levels can be significant depending on the amount of sand and small aggregate that is transported along the roads, and how much mud and sand accumulates on the roads that is spread from the tires of the construction vehicles.

369. Dust will pose the biggest problem for residents alongside the roadways to be upgraded or near the new road alignments. Dust generated from the construction sites will be restricted to dust blown from aggregate piles on site.

370. For the purpose of this IEE, the component "Infrastructure for University Area of Vinh Yen City" is chosen to calculate quantitative amount of dust levels and exhausted gases during construction phase in view of its new construction road, running through some residential areas and big scope of work comparing with other road components of other cities. The characteristic of the dust and exhausted gases generated by construction activities is dispersed and discontinuous. Based on the total volume and the coefficient in Table 48, construction time (24 months), the length of roads, the load of dust emission is calculated in Table 65 and the disperstion of dust predicted in Table 66.

Table 67. Load of dust emission from construction activities

Items	Volume of infill and excavate (kg)	Volume of dust (kg)		Length	Time	Load of Dust Emission (E) (mg/m/s)	
		Min	Max	m	Months	Min	Max
Road construction	3,345,183	3,345	334,518	5,611	24	0.0111	2.2116

Table 68. Dust dispersion (mg/m^3) for Infrastructure for Univeristy Area Component

Distance x (m)	z (m)				
	1	**2**	**3**	**4**	**5**
5	**0.69**	**0.43**	0.20	0.07	0.02
10	**0.47**	**0.39**	0.29	0.19	0.11
20	0.30	0.28	0.25	0.21	0.17
25	0.25	0.24	0.22	0.20	0.17
50	0.16	0.15	0.15	0.14	0.13
100	0.09	0.09	0.09	0.09	0.09
QCVN 05:2013/BTNMT (In an hour)	0.30				

371. Thus, the dust levels arising from the road construction at the spots within the areas having x of 5, 10 m and z of 1-2 m exceeding the standard QCVN 05: 2013 / BTNMT: National Technical Regulation on ambient air quality. The amount of oil consumed by construction equipment/machine as shown in Table 67 is extimated according to the number of equipment/machine mobilized for the component and the standard rate of consumtion for oil in Circular No. 06 / 2010 dated 26/5/2010 method to determine machine shift price.

Table 69. Estimated volume of oil consumed by the componet

Consumed oil (lít)	Consumed oil (tấn)
794,655	661.15

(a liter of diesel =0,832 kg)

372. The loads of air pollutants (Table 68) generated by construction and transportation are calculated based on the coefficients of pollution established by US EPA and WHO for operation of trucks more than 16 ton which is indicated that a truck 16 ton emits SO_2 =7,43xS kg/km (S=0.5%), NO_2=24,1 kg/km; CO=3,7 kg/km.

Table 70. Loads of air pollutant from construction equipment

Total volume of air pollutant generated by the component (kg)			Calculated leghth	Construction time (month)	The loads of air pollutant (mg/m/s)		
CO_2	SO_2	NO_2			CO_2	SO_2	NO_2
18,512	26,446	36,363	5,611	24	0.2448	0.3498	0.4809

373. Using the Sutton equation, the dispersion of air pollutant concentrations from construction of the component is presented in Tables 69, 70 and 71.

Table 71. Dispersion of CO (mg/m^3) from "Infrastructure of University area"

Distance x (m)	z (m)				
	1.0	2.0	3.0	4.0	5.0
5	0.0213	0.0133	0.0061	0.0020	0.0005
10	0.0145	0.0121	0.0090	0.0059	0.0034
20	0.0092	0.0086	0.0077	0.0066	0.0054
25	0.0079	0.0075	0.0069	0.0062	0.0053
50	0.0048	0.0047	0.0046	0.0044	0.0042
100	0.0029	0.0029	0.0029	0.0028	0.0028
QCVN 05:2013/BTNMT (in an hour)	30 (mg/m^3)				

Table 72. Dispersion of SO_2 (mg/m^3) from "Infrastructure of University area"

Distance x (m)	z (m)				
	1.0	2.0	3.0	4.0	5.0
5	0.0304	0.0191	0.0087	0.0029	0.0007
10	0.0207	0.0173	0.0128	0.0084	0.0049
20	0.0131	0.0123	0.0110	0.0094	0.0077
25	0.0112	0.0107	0.0099	0.0088	0.0076
50	0.0068	0.0067	0.0065	0.0063	0.0059
100	0.0041	0.0041	0.0041	0.0040	0.0039
QCVN 05:2013/BTNMT (in an hour)	0.350 (mg/m^3)				

Table 73. Dispersion of NO_2 (mg/m^3) from "Infrastructure of University area"

Distance x (m)	z (m)				
	1.0	2.0	3.0	4.0	5.0
5	0.0418	0.0262	0.0120	0.0040	0.0010
10	0.0285	0.0238	0.0177	0.0116	0.0068
20	0.0180	0.0169	0.0151	0.0129	0.0106
25	0.0154	0.0147	0.0136	0.0121	0.0105

Distance x (m)	z (m)				
	1.0	**2.0**	**3.0**	**4.0**	**5.0**
50	0.0094	0.0093	0.0090	0.0086	0.0082
100	0.0057	0.0057	0.0056	0.0055	0.0054
QCVN 05:2013/BTNMT (in an hour)	**0.200 (mg/m^3)**				

374. According the result, the air pollutant concentration from construction of the component is acceptable in regards to the standard QCVN 05:2013/BTNMT.

Mitigation

375. Wetting agents should be applied regularly to all construction roads. Trucks carrying aggregate should always be covered. All construction vehicles should be kept in good working order.

v. Water quality

376. The effects of road works on erosion and sedimentation identified for aquatic habitat apply to water quality. The other common source of surface water pollution is from oil, gas, and grease from the operation [and maintenance] of heavy equipment in, and near surface waters. Fuel tanks can leak, and spent oil and grease can also be discharged in or near the lakes or streams. Waterbodies affected by road components are shown in Table 72

Table 74. Waterbodies affected by the road components

Component	Location of waterbody	Description of waterbody
Vinh Yen Subproject		
Infrastructure development for University area	The road component does not cross through any river or stream more than 3 m in width	The water sources affected by road component are irrigation and drainage canals as well as local small fish ponds
Hue Subproject		
Bui Thi Xuan road	The component shall improve an existing road named Ngoc Long at the beginning of the road.	This bridge crosses over a local drainage canal of 10 m in width. No fishing and aquaculture activities is on this canal
Huyen Tran Cong Chua road	No water sources affected	
Bridge connecting Area A and B of An Van Duong Development Area	The component shall build a bridge that crosses over Nhu Y river	Refer to chapter 2 for Nhu Y river's information
Vy Da Bridge Expansion and Access Road	The component shall upgrade the current Vy Da Bridge that crosses over Nhu Y river	Refer to chapter 2 for Nhu Y river's information

Ha Giang Subproject		
New Road on the East bank of Mien river	The component run along Mien river and does not cross through any water ways more than 3 m in width	Refer to chapter 2 for Mien River's information The other water sources affected by road component are drainage canals as well as local small fish ponds
Southern Ring Road	The component run along Lo river and does not cross through any water ways more than 3 m in width	Refer to chapter 2 for Lo River's information The water sources affected by road component are drainage canals as well as local small fish ponds
New bridge from NH2 to Southern ring road	The component shall build a bridge cross over Lo river	Refer to chapter 2 for Lo River's information
Upgrading of National Road No.2	No water sources affected	

Mitigation

377. As stated for aquatic habitat, berms should be applied to construction areas to separate shoreline works from affected rivers and lakes. Heavy equipment should not be maintained near water courses. Waste oils and grease should be disposed in designated sites.

vi. Solid and domestic waste

378. Road construction will generate construction material waste, and domestic waste from workers. Work camps whether temporary or long term provide places to eat and sleep for workers. Camps provide pit latrines and supplies of potable water for cooking and bathing. Domestic liquid and solid waste can become a local problem depending on the size of the camp, and compliance with formal waste management procedures.

Mitigation

379. A formal waste collection and disposal program should be instated all construction sites. All waste construction material must be stored and removed from site daily or weekly. Worker living areas must be provided with adequate garbage bins, and garbage collected and transported to local landfill regularly. Pit latrine areas must be kept clean, and buried when camp closed

vii. Reduced road access, increased traffic, and risk of traffic accidents

380. Road construction will create traffic and access problems at, and near the roads that are under construction, and along roadways used by construction vehicles. This will be particularly prevalent in the urban core areas where traffic density is highest. Thus, access and movement of residents in and around the Citadel in Hue will be affected the most by the embankments works compared to the less dense areas of the embankments works in Ha Giang and around Dam Vac lake in Vinh Yen.

Mitigation

381. A traffic management plan must be put in place for local and construction traffic near the embankment component sites. Enforced speed limits must be well posted, and additional traffic direction signs to assist both construction and local traffic should be posted outside and inside construction zones and along construction truck routes.

f. Additional Common Construction Mitigation Measures

382. The following mitigation measures for construction phase impacts and disturbances are commonly applied to projects in Viet Nam. Along with the mitigations identified for the different component types, the common mitigations below will be included where appropriate in the three EMPs for the city subprojects. The below generic construction mitigation measures are defined in the EMPs. The contractors will be required to reflect these measures in their site-specific construction EMPs, to be submitted to the the project management and construction supervision consultants (Hue, Ha Giang) and the safeguards and social monitoring consultants (Vinh Yen) and the PMUs for review and approval prior to construction. Monitoring will be carried out by the project management and construction supervision consultants (Hue, Ha Giang) and the safeguards and social monitoring consultants (Vinh Yen) during the construction period.

383. **Air pollution control measures**. The Contractor shall include all necessary measures to reduce air pollution and dust development that would impact public health, by implementing the following air quality control measures. Most of these measures are generic measures that are applicable to all construction sites and construction activities as good practice. Yet these are effective measures and are also described in the World Bank Group's EHS General Guidelines as summarized below.

(i) Build access and hauling roads at sufficient distances from residential areas, particular, from local schools and hospitals.
(ii) Assign haulage routes and schedules to avoid transport occurring in the central areas, traffic intensive areas or residential areas. For the areas with high-demand on environmental quality, transport should be arranged at night.
(iii) Spray water regularly on unpaved haul roads and access roads (at least once a day) to suppress dust; and erect hoarding around dusty activities.
(iv) Cover material stockpiles with dust shrouds or tarpaulin. For the earthwork management for backfill, measures will include surface press and periodical spraying and covering. The extra earth or dreg should be cleared from the project site in time to avoid long term stockpiling.
(v) Minimize the storage time of construction and demolition wastes on site by regularly removing them off site.
(vi) Site asphalt mixing and concrete batching stations at least 300 m downwind of the nearest air quality protection target.
(vii) Equip asphalt, hot mix and batching plants with fabric filters and/or wet scrubbers to reduce the level of dust emissions.
(viii) Install wheel washing equipment or conduct wheel washing manually at each exit of the works area to prevent trucks from carrying muddy or dusty substance onto public roads.
(ix) Keep construction vehicles and machinery in good working order, regularly service and turn off engines when not in use.
(x) 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.

(xi) In periods of high wind, dust-generating operations shall not be permitted within 200 m of residential areas. Special precautions need to be applied in the vicinity of sensitive receptors such as schools, kindergartens and hospitals.

(xii) Site all dredged sediment storage or disposal facilities at least 50 m from the nearest air quality protection target.

(xiii) To avoid odor impacts caused by sediment dredging, transport dredged sediment in closed tank wagons to contain odor and prevent scattering along the way.

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

384. **Mitigation of construction noise impact**. Contractors will be required to implement the following mitigation measures for construction activities to meet VIE construction site and IFC/WHO recommended environmental noise standards and to protect sensitive receptors. Some measures are generic and are applicable to all construction sites and activities. Yet they represent good practice and are effective measures, and are also in line with IFC's EHS guidelines.

(i) During daytime construction, the contractor will ensure that: (1) noise levels from equipment and machinery conform to the IFC EHS Standards, and properly maintain machinery to minimize noise; (2) equipment with high noise and high vibration are not used near village or township areas and only low noise machinery or the equipment with sound insulation is employed; (3) sites for concrete-mixing plants and similar activities will be located at least 300 m away from the nearest noise protection target; and (4) temporary noise barriers or hoardings will be installed around the equipment to shield residences when there are residences within 20 m of the noise source.

(ii) No construction is allowed between the night time hours of 22:00 to 06:00.

(iii) Regularly monitor noise levels at construction site boundaries. If noise standards are exceeded by more than 3 dB, equipment and construction conditions shall be checked, and mitigation measures shall be implemented to rectify the situation.

(iv) Provide the construction workers with suitable hearing protection (ear muffs) according to the worker health and safety law of Viet Nam.[41]

(v) Control the speed of bulldozer, excavator, crusher and other transport vehicles travelling on site, adopt noise reduction measures on equipment, step up equipment repair and maintenance to keep them in good working condition.

(vi) Limit the speed of vehicles travelling on site (less than 8 km/h), forbid the use of horns unless absolutely necessary, minimize the use of whistles.

(vii) Maintain continual communication with the villages and communities near the construction sites, and avoid noisy construction activities during school examination periods.

385. River dredging, embankment construction, wastewater and water pipeline installation and road construction are all linear activities. When construction is completed at a location, the activities move on and away. Construction noise impact is therefore short term. The above measures are defined in the EMPs. These will be supervised by by the project management and construction supervision consultants (Hue, Ha Giang) and the safeguards and social monitoring consultants (Vinh Yen). Contractors will be required to ensure compliance with WHO standard for

[41] Law on Occupational Health and Safety No. 84/2015/QH13; Law on Construction No.50/2014/QH13; Circular No. 22/2010/TT-BXD on labor safety in construction.

noise (55 db(A) daytime noise at sensitive sites). Noise monitoring will be carried out by the above consultants during the construction period. With these measures in place and implemented, noise impacts during construction would comply with applicable standards.

386. **Mitigation measures to prevent water pollution**. The contractors will implement the following measures to prevent water pollution:

(i) Portable toilets and small package wastewater treatment plants will be provided on construction sites and construction camps for the workers and canteens. If there are nearby public sewers, interim storage tanks and pipelines will be installed to convey wastewater to those sewers.
(ii) Sedimentation tanks will be installed on construction sites to treat process water (e.g. concrete batching for bridge construction) and muddy runoff with high concentrations of suspended solids. If necessary, flocculants such as polyacryl amide (PAM) will be used to facilitate sedimentation.
(iii) Construction machinery will be repaired and washed at special repairing shops. No onsite machine repair and washing shall be allowed.
(iv) Material stockpiles will be protected against wind and runoff waters which might transport them to surface waters.
(v) Dedicated fuel storage areas must be established away from public areas and marked clearly.
(vi) Storage of bulk fuel should be on covered concrete pads away from the public and worker camp. Fuel storage areas and tanks must be clearly marked, protected, and lighted. Contractors should be required to have an emergency plan to handle fuel and oil spillage.
(vii) Mitigation of water quality impact during bridge construction, dredging, cofferdam construction and water pumping out of the cofferdam will be based on water quality monitoring results.
(viii) Berms and/or silt curtains should be constructed around all excavation/trench sites and along all surface waters to prevent soil erosion and surface water sedimentation.

387. **Earthwork, soil erosion control measures**. The contractors will implement the following measures related to earthwork management:

(i) Present and past land use should be reviewed to assess whether excavated soils are contaminated spoil. Contaminated spoil should be disposed at a nearby landfill or a location approved by DONRE.
(ii) Confirm location of the borrow pit and temporary spoil storage and final disposal sites, securing permits from relevant DONREs.
(iii) Develop borrow pit and spoil disposal site management and restoration plan, to be approved by responsible authority; obtain permit for the clearance of excavated earthworks.
(iv) Construct intercepting ditches and drains to prevent runoff entering construction sites, and diverting runoff from sites to existing drainage.
(v) Construct hoardings and sedimentation ponds to contain soil loss and runoff from the construction sites.
(vi) Limit construction and material handling during periods of rains and high winds.
(vii) Stabilize all cut slopes, embankments, and other erosion-prone working areas while works are going on.
(viii) Stockpiles shall be short-termed, placed in sheltered and guarded areas near the

actual construction sites, covered with clean tarpaulins, and sprayed with water during dry and windy weather conditions.

(ix) All earthwork disturbance areas shall be stabilized with thatch cover within 30 days after earthworks have ceased at the sites.

(x) Immediately restore, level and plant landscape on temporary occupied land upon completion of construction works.

(xi) Implement all soil erosion protection measures as defined in the soil and water conservation reports.

388. **Ecological impact mitigation measures**. The contractors will implement the following measures to prevent ecological impact during construction:

(i) Preserve existing vegetation where no construction activity is planned.

(ii) Protect existing trees and grassland during construction; where a tree has to be removed or an area of grassland disturbed, replant trees and re-vegetate the area after construction.

(iii) Remove trees or shrubs only as the last resort if they impinge directly on the permanent works or necessary temporary works.

(iv) Prior to commencement of construction, tag and conspicuously mark all the trees to be preserved to prevent damage to these trees by construction workers.

(v) Construction workers are prohibited from capturing any wildlife in the project areas.

389. **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 civil works contractors will implement adequate precautions to protect the health and safety of construction workers. Contractors will manage occupational health and safety risks by applying the following measures:

(i) To minimize the impact of construction on the public and workers, the specific guidelines for safety of the worker and public set down by the Ministry of Labor, Invalids and Social Assistance (MOLISA) must be followed. The IFC/World Bank Environment, Health, and Safety Guidelines (2007) that govern the safe and orderly operation of civil works should be added as supplementary guidance if needed.

(ii) Care must be taken to ensure that sites for all earthworks (e.g., excavations, trenches) and dredging that are suspected to have unexploded ordnance (UXO) are surveyed by the military prior to construction. If such ordnance is detected clearing work will need to be commissioned prior to undertaking civil works.

(iii) Construction site sanitation: (1) Each contractor shall provide adequate and functional systems for sanitary conditions, toilet facilities, waste management, labor dormitories and cooking facilities. Effectively clean and disinfect the site. During site formation, spray with phenolated water for disinfection. Disinfect toilets and refuse piles and timely remove solid waste; (2) Exterminate rodents on site at least once every 3 months, and exterminate mosquitoes and flies at least twice each year; (3) 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; (4) Work camp wastewater shall be discharged into the municipal sewer system or treated on-site with portable system.

(iv) Occupational safety: (1) Provide safety hats and safety shoes to all construction workers; (2) Provide safety goggles and respiratory masks to workers doing asphalt road paving and tunnel blasting; (3) Provide ear plugs to workers working near noisy

PME.

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

(vi) Disease prevention, health services: (1) All contracted labor shall undergo a medical examination which should form the basis of an (obligatory) health/accident insurance and welfare provisions to be included in the work contracts. The contractors shall maintain records of health and welfare conditions for each person contractually engaged; (2) 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; (3) Specify (by the PMUs and contractors) the person(s) responsible for health and epidemic prevention responsible for the education and propaganda on food hygiene and disease prevention to raise the awareness of workers.

(vii) 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 (1) employ local people for works, (2) ensure equal opportunities for women and men, (3) pay equal wages for work of equal value, and to pay women's wages directly to them; and (4) not employ child or forced labor.

390. **Community health and safety**. Temporary traffic diversions, continual generation of noise and dust on hauling routes, and general hindrance to local accesses and services are common impacts associated with construction works within or nearby local settlements.The project may also contribute to road accidents through the use of heavy machinery on existing roads, temporarily blocking pavements for pedestrians etc. The potential impacts on community health and safety will be mitigated through a number of activities defined in the EMPs. The contractors will implement the following measures:

(i) Temporary Traffic management: A traffic control and operation plan will 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: Residents and businesses will be informed in advance through media of the construction activities, given the dates and duration of expected traffic disruption.

(iii) Construction sites: Clear signs will 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. Heavy machinery will not be used after day light and all such equipment will be returned to its overnight storage area/position before night. All sites will be made secure, discouraging access by members of the public through appropriate fencing whenever appropriate. Open excavations should be fenced, and trenches covered where public walkways or vehicles must cross.

4. Operation Phase

391. The potential impacts during the operation of the completed subprojects focus on the new WWTP in Vinh Yen, river and lake embankment maintenance, and the new and upgraded roads in all three cities.

a. WWTP in Vinh Yen

392. Potential water quality impact would result from the discharge of treated effluent from the WWTP into Dam Coi Pond and the Dam Vac Lake. Through treatment to QCVN Level B standard for irrigation waters (intial receiving environment is irrigation ponds), substantial amount of pollutants will be removed every year, benefiting the water quality of the Dam Vac Lake, which currently receives untreated wastewater. The effluent discharge location of the WWTP are not located in any protection zone. An assessment was conducted to confirm the ability of the receiving water body to cope with the point-source pollution (treated effluent).

393. Based on conservation of mass in accordance with Circular No. 02/2009/TT-BTNMT dated March 19, 2009 on appraisal of the wastewater receiving ability of water resources, the wastewater receiving ability of Dam Coi Pond is shown in the following equation:

Pollutant receiving ability of water resource	≈	Maximum ability for pollution loa	-	Existing pollution load in water resource

394. Since the function of the WWTP is to treat domestic wastewater, the report will only assess maximum pollution load of typical pollutants such as BOD_5, COD, coliform, TSS, TP, and TN. The maximum pollution load that the Dam Coi Pond is able to receive is calculated according to the following formula:

$$\mathbf{L_{td} = (Q_s + Q_t) * C_{tc} * 86.4}$$

in which:

- $\mathbf{L_{td}}$ (kg/day) = maximum pollution load of water resource for identified pollutant
- $\mathbf{Q_s}$ (m^3/s) = minimum discharge at the river segment to be assessed before receiving wastewater (m^3/s)
- $\mathbf{Q_t}$ (m^3/s) = maximum wastewater discharge
- $\mathbf{C_{tc}}$ (mg/l) = limit value of pollutant concentration of water resource to be assessed in Dam Coi (field survey value)
- **86,4** - dimension unit conversion factor from (m^3/s)*(mg/l) into (kg/day).

395. Applying the formula of calculating the maximum pollution load: $L_{td} = (Q_s + Q_t) * C_{tc} * 86.4$, as a result: Maximum pollution loads that water resource can receive for above-mentioned pollutants are as follows:

Parameters	**BOD_5**	**COD**	**Coliform**
($Q_s + Q_t$) m^3/s	*1.069 m^3/s*	*1.069 m^3/s*	*1.069 m^3/s*
Limit value = C_{tc}	17.3 mg/l	37.12 mg/l	6,600 mpn/10000
L_{td}	1,598 kg/day	3,429 kg/day	609,839 mpn/1000

396. Existing pollution load in the receiving water body for an identified pollutant is calculated according to the following formula:

$$\mathbf{L_n = Q_s * C_s * 86.4}$$

in which:

- **L_n** (kg/day) = existing pollution load in receiving water resource;
- **Q_s** (m^3/s) = minimum discharge at the river segment to be assessed before receiving wastewater
- **C_s** (mg/l) = maximum concentration value of pollutant in water resource before receiving wastewater.
- **86.4:** = dimension unit conversion factor from (m^3/s)*(mg/l) into (kg/day)

Parameters	**BOD_5**	**COD**	**Coliform**
(Q_s) m^3/s	*1.0 m^3/s*	*1.0 m^3/s*	*1.0 m^3/s*
Limit value = Cs (mg/l)	17.3 mg/l	37.12 mg/l	6,600 mpn/10000
L_n (kg/day)	18.3 kg/day	38.12 kg/day	6,601 mpn/10000

397. The pollution load of a certain pollutant from the WWTP into the receiving water resource is calculated according to the following formula:

$$L_t = Q_t * C_t * 86.4$$

in which:

- **L_t** (kg/day) = pollution load into discharging resource;
- **Q_t** (m^3/s) = maximum wastewater discharge
- **C_t** (mg/l) = maximum concentration value of pollutant in wastewater

Parameters	**BOD_5**	**COD**	**Coliform**
(Qt) m^3/s	*0.069 m^3/s*	*0.069 m^3/s*	*0.069 m^3/s*
Limit value = Ct (mg/l)	50 mg/l	80 mg/l	5,000 mpn/10000
L_t (kg/day)	300 kg/day	480 kg/day	30 mpn/10000

398. The pollution load receiving capacity of the water body for a certain pollutant from a single discharging point is calculated according to the following formula:

$$L_{tn} = (L_{td} - L_n - L_t) * F_s$$

in which:

- ***L_{tn}** (kg/day) = pollution load receiving ability of water resource;*
- ***F_s** = safety factor = 0.4 (to be applied to receiving water resources as lake, pond)*

Parameter	**BOD_5**	**COD**	**Coliform**
Ltd	1,598.5 kg/day	3,429.9 kg/day	609,839 mpn/10000
Ln	18.3 kg/day	38.1 kg/day	6,601 mpn/10000
Lt	300 kg/day	480 kg/day	30 mpn/10000
L_{tn} (kg/d)	530.3 kg/day	1,203.9 kg/day	248,253 mpn/10000

399. The above table confirms that the Dam Coi Pond is able to assimilate pollutants from effluent discharge in terms of BOD_5, COD and Coliform (based on the calculation above, the pollution loads of BOD_5 and COD are 300 and 480 (kg/day) respectively from the operation of WWTP) The distance from Dam Coi Pond to Phan River is approximately 2 km and from Phan

River to Dam Vac Lake is approximately 2 km. The total distance from the WWTP to Dam Vac Lake is thus about 4 km. With the self-cleaning capacity of the Dam Coi Pond and such a distance from Dam Coi to Dam Vac Lake, the impact of treated wastewater discharge to Dam Vac Lake is expected to be minimal. The performance of the WWTP and compliance with the QVCN-B discharge standard will be monitored contiuously by the WWTP operator. Regular surface water monitoring at the effluent discharge point will be conducted by the Vinh Phuc DONRE to confirm this prediction.

400. When in full operation the WWTP could become a source of odour to local residents if the site is not at least 200 meters from nearest homested as required by Viet Nam law. Potential odor sources in the WWTP include the intake screen, influent pump room, fine screen, sludge dewatering pump house, sludge storage tank and sludge drying beds. Emissions of odorous chemicals such as NH_3 and H_2S from WWTPs are regulated by the standard: QCVN 06:2009/BTNMT – National Technical Regulation on hazardous subtances in ambient air. The WWTP will have to comply with this standard, with the maximum allowable concentrations of NH_3 and H_2S at the plant boundary being 200 µg/m^3 and 42 µg/m^3 respectively. The sensitive receptor nearest to the WWTP is approximately 200 m from the plant boundary. In addition to buffer distance, the WWTP must be surrounded by an elevated dense treed perimeter to act as a wind and sound break for the operations of the WWTP.

401. Operational noise impact could potentially come from the WWTP. Noise levels from equipment range from 75-110 dB(A) according to estimates provided in the domestic EIA. To mitigate potential noise impacts, the WWTP will use low noise equipment and building walls with sufficient thickness and acoustic measures such as barriers or sound absorbing materials. The WWTP operator will also diligently maintain such equipment to keep them in good working conditions. With the above mitigation measures in place, noise levels from equipment could be reduced to 70-95 dB(A). Noise levels at the WWTP boundaries would meet the IFC standard (45 db(A) at night, 55 dB(A) at day). This will verified by the project supervision consultants until the PCR is issued.

402. Approximately 350 tons per year of dewatered sludge (<60% moisture content) will be generated from the WWTP during operation. Sludge drying beds will be constructed on the WWTP site for air drying the sludge to <60% moisture content for landfill disposal.

403. Wastewater treatment plant operation staff are exposed to occupational risks of falls on wet floors or into treatment ponds, pits, clarifiers or vats, splashes of hazardous liquids, or cuts and contusions from equipment, etc. The following measures will be implemented to safeguard the safety and health of WWTP operator: (i) compulsory use of safety shoes or boots with non-slip soles, protective equipment, and chemical resistant clothing and safety goggles to avoid exposure of skin or eyes to corrosive and/or polluted solids, liquids, gases or vapors; (ii) posting of safety instructions in each workshop regarding the storage, transport, handling or pouring of chemicals; (iii) check electrical equipment for safety before use; verify that all electric cables are properly insulated; take faulty or suspect electrical equipment to a qualified electricity technician for testing and repair; and (iv) adherence to safety instructions concerning entry into confined spaces. All workers will undergo periodic examinations by occupational physician to reveal early symptoms of possible chronic effects or allergies. Finally, health and safety will be incorporated into the regular staff training programs.

b. Rivers, Canals, Lakes

404. The operation of the river, canal and lake subprojects is not expected to generate major impacts. The mitigation measures for environmental impact during operation includes properly maintaining all river embankment vegetation, emergent aquatic plants and other vegetation; and inspecting all river embankment for stability issues. If signs of failure are discovered, a repair program will be implemented immediately. The rivers will also require periodic maintenance to remove garbage or excessive plant growth.

405. **Periodic river channel maintenance.** The flood flow capacity of the project rivers may be severely impaired as a result of accumulations of sediments, garbage, uncontrolled plant growth and the construction of weirs built to provide either irrigation water. The DARDs will be responsible for the maintenance of the rehabilitated rivers. They will appoint sufficient personnel to regularly maintain the river, including removal of garbage and vegetation which may impair flood flow capacity.

406. **Hydrological impacts from river embankments.** River embankments may result in higher water velocities and/or volumes moving downstream, posing risks to communities and lands downstream of the project area, as well as changes in channel morphology. The FSR estimated that the project will result in only small increases (0.1-0.2 meters per second) to mean annual flood velocities in the project rivers. The average channel gradient of project rivers will not be changed – dredging will maintain the existing gradient. The embankment designs are designed to absorb changing water levels and flow velocities through the maximum use of vegetation, graded revetments, and rough and porous textures. On the basis of this information, it is concluded the project does not present significant risks to downstream residents, lands, or channel morphology.

c. New and Upgraded Roads

407. Traffic and risk of roads accidents will arise with the new and upgraded roads in all three subproject cities. Noise will increase from the increase in traffic. Motor vehicles travelling on the roads will emit air pollutants via exhaust.

408. Most important pollutants include NO_2, CO, SO_2 and TSP (including dust). Of these, the critical air pollutant is NO_2, meaning that if NO_2 complies with the applicable standard, other pollutants such as CO, HC and PM should also comply with their respective standards.

409. The sub-component “Infrastructure of University Area” is chosen as a case for this IEE to assess the impacts related to dust and air pollution during the operation phase of the road component. Average concentration of pollutants in the air at a certain time is defined following the formula of Sutton as follows (Pham Ngoc Dang; Air environment, Scientific and Technical Publisher, 1997):

$$C = 0{,}8E\{\exp[-(z+h)^2/2\sigma_z^2] + \exp[-(z-h)^2/2\sigma_z^2]\}/(\sigma_z.U)$$

In which:

- C: concentration of air pollutants (mg/m^3)
- E: emission source (mg/m/s)

- σ_z: diffusion coefficient following z direction (m) is function of distance x following wind direction.
- z: height of calculated point (m)
- U: average wind velocity (m/s)
- h: road surface elevation compared with surrounding ground (m)

410. According to the technical design documents, the traffic forecast for the road of the component is shown in Tables below.

Table 75: Forecast demand on road for "Infrastructure of University Area" (year 2030)

	Moto-bikes	Cars	Buses	Total (turns/day &night)	Average turn/h	Rush hour turn/h
Traffic flow	38,462	5,000	750			
Conversion factor to Car	0.5	1	2.5			
Car trips	19,231	5,000	1,875	26,106	1,088	3,264

Source: FS report 2017

411. Air pollution coefficient: Because there is currently no standard data on emission sources of pollutants from vehicles in Viet Nam, air pollution coefficients for various traffic means are established based on the reference document of the World Health Organization (WHO), Environmental Technique Manuals, Volume 1: "Assessment on air, water and land pollution sources", Geneva, 1993. Given significant improvements in vehicle technology and pollution control, this is considered a concervative approach.

Table 76. Air pollution coefficient of cars

Types of vehicle	Unit (U)	TSP kg/U	SO_2 kg/U	NO_x kg/U	CO kg/U	VOC kg/U
Car	1000 km	0.07	2.05S	1.19	7.72	0.83

Note: *U is the consumed fuel quantity for a distance of 1000-km (100 Liters); S is sulphur content in gasoline and oil. Following Vietnamese regulation QCVN 1: 2007/BKHCN National Technical Regulation on gasoline and diesel fuel: For cars and buses using diesel oil with content not exceeding 500mg/kg or S=0.05 (%).*

Table 77. Load of air pollutant along the road of "Infrastructure of University Area"

Year 2030	Turn/hour	TSP	SO_2	NOx	CO	VOC
		mg/m/s	mg/m/s	mg/m/s	mg/m/s	mg/m/s
Total emissions (kg/1000km)		0.07	0.103	1.19	7.72	0.83
Average	1,088	0.021	0.031	0.360	2.333	0.250
Rush hour	3,264	0.063	0.093	1.078	6.999	0.752

412. Dust from road surface: The prediction of dust emissions during road operation is conducted based on the forecast of emission volume on the route. Apart from particular matter (PM) generated from engines, there is also dust generated from friction of vehicle wheels and road surface. Forecast emission volume is calculated based on an emission coefficient.

413. At present, there is no guidance document or regulation on this coefficient in Viet Nam. In this case, coefficients of advanced countries are applied. Following guidance of the United States Environmental Protection Agency (http://www.epa.gov) and California Environmental Protection Agency (http://www.arb.ca.gov), the calculation of dust due to friction between vehicle wheels and road surface is as follows:

$$E = \left[k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5} \right] \times \left(1 - \frac{P}{4N} \right)$$

Source http://www.arb.ca.gov/ei/areasrc/PMSJVPavedRoadMethod2003.pdf

In which:

- E: emission coefficient on 1mil of one vehicle shift calculated following lb/VMT or lb/turn/mil (1 lb=340,1943 g; 1 mil = 1.609,3440m)
- k: is coefficient depending on dust size (PM10, PM2.5, ..). With PM10, k = 0,016 lb/VMT.
- sL: road surface emission coefficient of each road type (g/m^2)
- W: Average quantity (ton) of means on road (calculated with vehicle of 2.4 ton)
- P: number of rainy days in a year (average 145 days)
- N: number of days in a year (365 days).

Table 78. Emission coefficient

No.	Type of road	Emission coefficient of road surface sL (g/m^2)	k lb/VMT	W (ton)	E (lbPM10/turn/mil)	E (mgPM10/ turn/m)
1	Freeway	0.02	0.016	2.4	0.00051681	0.1092
2	**Arterial; Collector**	**0.035**	**0.016**	**2.4**	0.00074354	0.1572
3	Local road	0.32	0.016	2.4	0.00313333	0.6623
4	Rural road	1.6	0.016	2.4	0.00891941	1.8854

Table 79. Dust levels on road of "Infrastructure of University Area"

Year 2020	E (mg PM10/turn/m)	Volume (turn/h)	PM10 emission from road surface (mg/m.s)	PM10 emission from engine (mg/m/s)	Total PM10 emission (mg/m/s)
Average hour	0.1572	1088	0.048	0.021	0.069
Rush hour	0.1572	3264	0.143	0.063	0.206

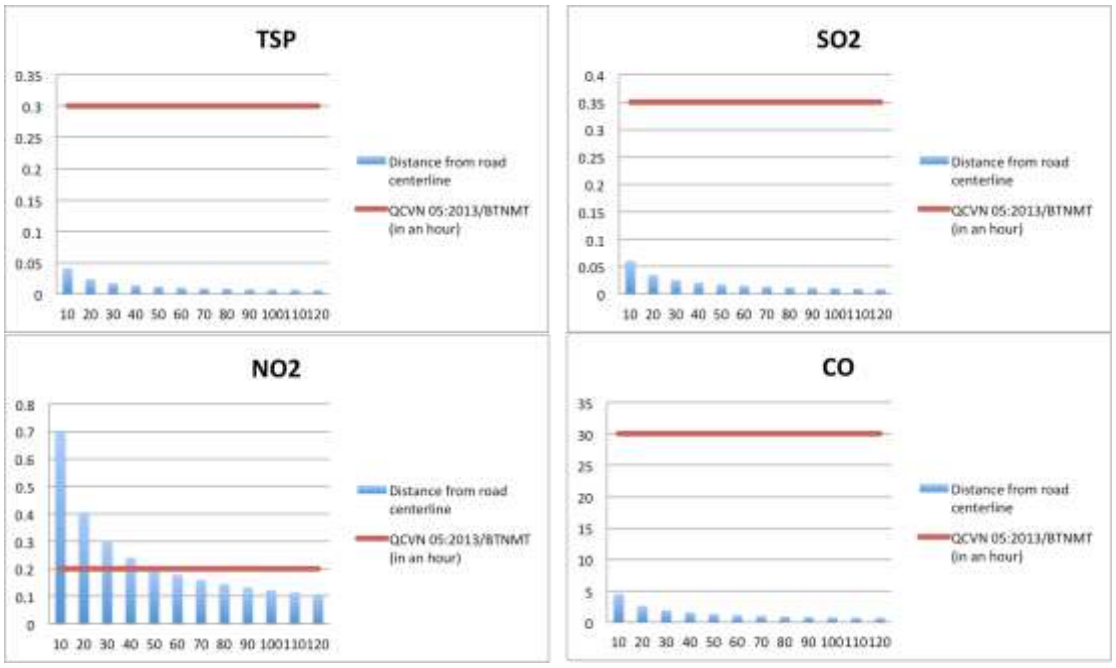
414. In order to focus on main impacts, the most disadvantageous conditions were calculated to determine parameters which may cause pollution. Disadvantageous conditions for the route operation is assumed: (i) Biggest traffic volume for the year 2030; (ii) relatively windless conditions, with wind velocity following perpendicular direction with the road at 1.4m/s; (iii) rush hour, with traffic volume 3 times higher than at average time. Calculation results in most disadvantageous conditions is as follows:

Table 80. Pollutant concentrations at rush hour for "Infrastructure of University Area"

Distance from road centerline x (m)	Diffusion coefficient following z direction	TSP (mg/m^3)	SO_2 (mg/m^3)	NO_2 (mg/m^3)	CO (mg/m^3)
10	2.8463	0.0412	0.0606	**0.7000**	4.5413
20	4.7209	0.0239	0.0351	**0.4058**	2.6325
30	6.3471	0.0176	0.0259	**0.2988**	1.9385
40	7.8303	0.0142	0.0209	**0.2412**	1.5647
50	9.2156	0.0120	0.0177	**0.2045**	1.3264
60	10.5275	0.0105	0.0155	0.1787	1.1596
70	11.7814	0.0094	0.0138	0.1596	1.0352
80	12.9877	0.0085	0.0125	0.1447	0.9385
90	14.1538	0.0078	0.0115	0.1327	0.8607
100	15.2854	0.0072	0.0106	0.1228	0.7967
110	16.3867	0.0067	0.0099	0.1145	0.7430
120	17.4614	0.0063	0.0093	0.1075	0.6971
QCVN 05:2013/BTNMT (in an hour)		0.3	0.35	0.2	30

415. Predictions indicate that the concentrations of TSP, SO_2 and CO from peak hour traffic emissions would comply with the Viet Nam's Air Quality Standard (QCVN 05:2013/BTNMT) at the road shoulder in year 2030. However, as the table above indicates, during most disadvantageous conditions, NO_2 may exceed the air quality standard while all other parameters are expected to be within standard limits. The area potentially affected by NO_2 from road centerline is 50m. New developments along the road will need to have a minimum buffer distance from the road shoulder. The area is currently sparsely populated and new university campuses will be established. Buildings are not anticipated to be built closer than 30-50m from the road shoulder. Air quality monitoring will be conducted regularly by the relevant DONRE and contingency plans (including temporary traffic bans in case of significant air pollution events) will be implemented as needed. Most importantly, strict access control for vehicles not complying with emission standards of Viet Nam (QCVN 05:2009/BGTVT) will be enforced by the local traffic police.

Figure 73. Pollutants concentrations at rush hour "Infrastructure of University Area" 2030



416. In order to determine affect of traffic noise on the surrounding environment and on public health, it is necessary to define noise transmission level to the surrounding environment. Forecast on noise level on the surrounding environment along the main traffic route in the project area is always made based on noise transmission models. Model for noise transmission will be classified into 3 following types:

- Point source model.
- Line source model.
- Combined source model.

417. Noise of vehicle flow on road may be point source, road source or combined source depending on the distance of vehicles on road. Interval of vehicles on road is calculated following below formula:

$$S = 1000*V_{tb} / N$$

In which: V_{tb}: average velocity of vehicle flow
N is the vehicle quantity converted to cars

418. Noise transmission model can, by interpolate method, be determined to be point sorce, line source and combined source for the distance $S \geq 200m$, $S \leq 20m$, and $20m < S < 200m$ respectively.

Table 81. Distance of vehicles on road

Parameter	Unit	Average hour	Rush hour
Converted vehicle volume	Turns /h	1,088	3264
Average velocity	km/h	40.00	40.00
Distance among vehicles S	m	36.76	12.25

419. In order to determine noise level based on the distance between points to be calculated and their sources, it is necessary to calculate the noise decrease level following distance. According to *Pham Ngoc Dang, Air ambient, Ha Noi Science and Technics Publishing House 1997*, noise level of a car at 7.5 m is 77 dBA (L). If specific sound of noise source is always measured at height of 1.5m and at a position which is far away from noise source (vehicle flow) by r_1 = 7.5m, the noise level at the position which is far away from traffic noise source by r_2 will be reduced compared with the distance r_1 as follows:

Point source: $\Delta L1 = 20\lg (r_2/r_1)^{1+a}$

Road source (line source): $\Delta L2 = \Delta L1/2$ (used to calculated during Rush hour due to $S \leq$ 20m)

Combined source: $\Delta L3=(\Delta L1+\Delta L2)/2$ (used to calculated during Rush hour due 20m < S < 200m)

In which: a is the coefficient for noise absorption of ground topography:

- For Ashaplted/Concreted road surface: a=-0,1
- For exposed road surface without trees: a=0
- For ground with grass: a=0,1

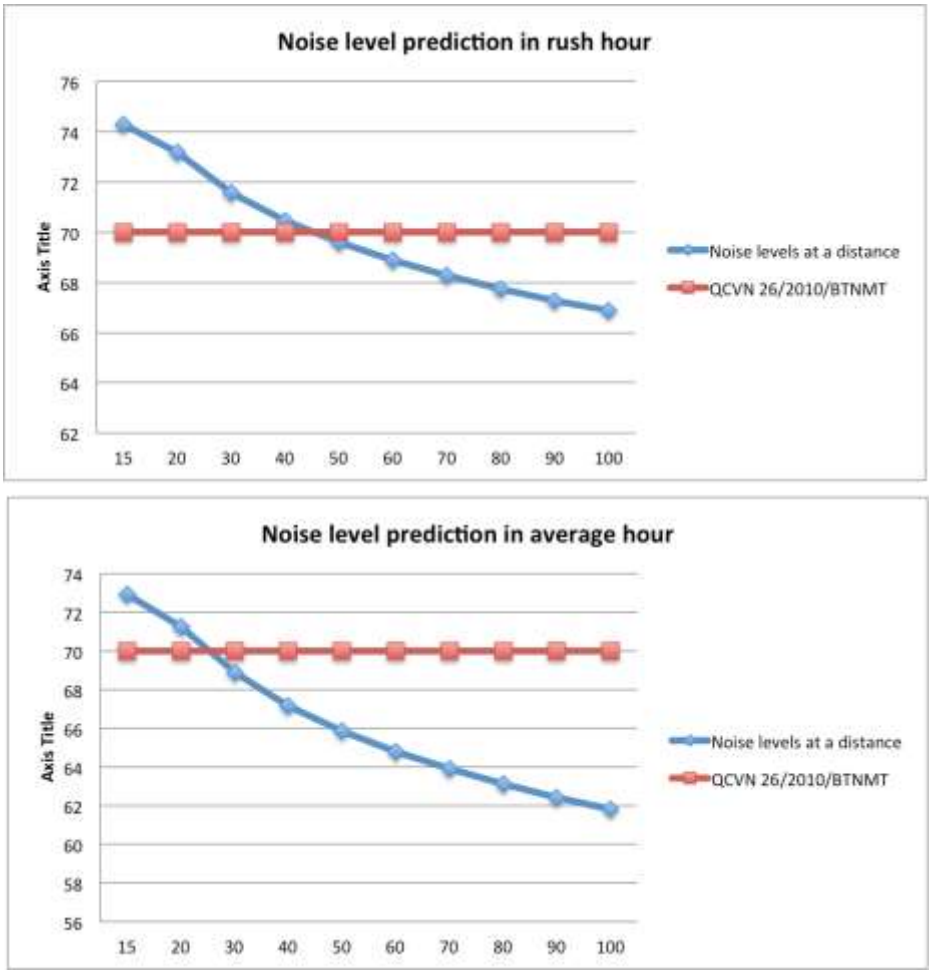
Select a=-0.1 noise calculation result is as in below table:

Table 82. Noise following distance (dBA)

Distance from road centerline (m)	R2/R1	Noise decreases following distance (dBA)		Noise level at a distance (dBA)	
		Average hour	Rush hour	Average hour	Rush hour
15	2	4.1	2..7	**72.9**	**74.3**
20	2.7	5.8	3.8	**71.2**	**73.2**
30	4	8.1	5.4	68.8	**71.6**
40	5.3	9.8	6.5	67.2	**70.5**
50	6.7	11.1	7.4	65.9	69.6
60	8	12.2	8.1	64.1	68.9
70	9.3	13.1	8.7	63.9	68.3

Distance from road centerline (m)	R2/R1	Noise decreases following distance (dBA)		Noise level at a distance (dBA)	
		Average hour	Rush hour	Average hour	Rush hour
80	10.7	13.9	9.3	63.1	67.7
90	12	14.6	9.7	62.4	67.3
100	13.3	15.2	10.1	61.8	66.9
QCVN 26/2010/BTNMT (Day time)				**70**	**70**

Figure 74. Noise forecasts in 2030 on the road of "Infrastructure of University Area"



420. Based on the noise level prediction, during operation up to 2030, local residential areas and institue buildings within 20 m and 40 from the road center line are likely to be affected by noise from traffic means during daytime. These predictions are very preliminary and subject to great uncertainty, which do not justify the definition of mitigation measures at this stage especially since this area will be re-developed as university zone, whereby most houses currently located within the road's area of influence will be eventually relocated. This is also likely to be the case for new roads proposed in Hue and Ha Giang.

421. This project therefore adopts the rationale of the IFC EHS guideline together with Viet Nam's noise standard, that if the increase in future noise level due to operation of a new road is more than 3 dB(A) compared to the existing noise level, and at the same time exceeds the present applicable day time or night time noise standard, the mitigation measure of providing double-glazed windows for affected households will be implemented. Ventilated double glazed windows will be provided to households at an estimated cost of VND 2 million per m^2. Follow up noise monitoring will be carried out at locations that are predicted to experience noise exceedance. The three EAs are committed to carry out a more detailed predictive analysis of sensitive receptor sites along the proposed project roads (to be conducted by the DI during detailed design), and to allocate funds for noise mitigation at affected properties and sensitive sites, as needed.

422. Concerns over the indirect community safety of project roads have been thoroughly examined during project preparation. First, the urban road subcomponents focus on improving the quality of roads and upgrading the existing roads by constructing pedestrian paths and separating motorized and non-motorized traffic. Pedestrian-priority push-button traffic lights, safe islands, crosswalks (zebra lines), boarding bays/islands and barrier-free lanes will be established at intersections. Sufficient road signs will be properly designed and placed in necessary locations. Road maintenance sites will be properly sealed, ahead signs placed and adequate number of safety officers posted to direct traffic. Road maintenance vehicles will be installed with warning lights, and staff will wear safety hats and reflective garments and undergo safety training. Trucks will be required to use non-core areas as much as possible. For example, through trucks will be forced to use the southern Ring Road instead of crossing through Ha Giang through city core.

D. Cumulative and Induced Impacts

423. Potential spatial cumulative impacts of the SCDP address: 1) multiple subproject components negatively affecting the same environmental receptor; and 2) joint positive impacts of SCDP components and external projects.

424. In Hue the Nhu Y River will be exposed to embankment works, the downstream expansion of the Vy Da bridge, and upstream construction of new bridge and approach roads all within 2 km. If these components are implemented at the same time the impacts, for example, on water quality, local traffic, and user of the river will be large. The Citadel in Hue is an environmental/cultural receptor that could be exposed to 6 concurrent components. Thus, if possible within implementation constraints, the close components should be staggered and not conducted concurrently where possible.

425. In Ha Giang the Lo River will be exposed to the upgrades to National Road #2, the new bridge crossing, and the construction of the southern ring road. Even if implemented serially, the temporal cumulative impacts will be high given that all three components will occur at the same place in the river.

426. Conversely, the effect of the new wastewater collection and treatment plant that DANIDA will construct in Ha Giang will enhance the impact of the rehabilitation of the stream-drainages. The removal of domestic wastewater from the streams will greatly enhance the restoration of the natural beauty of the vegetated streams, and their natural function as water purifiers and flow moderators.

427. The large reservoir near Dam Vac Lake that will be financed by the World Bank will provide additional standing water storage capacity for rainfall events. The additional storage coupled to the dredging and embankment works of the lake will strengthen further the resilience of Vinh Yen to climate change.

428. The potential spatial or temporal negative impacts of multiple SCDP components should be managed with careful scheduling of construction activities. The detailed scheduling of component implementation will occur at detailed design phase. The SCDP should consider the separate DANIDA and World Bank projects during detailed design stage to ensure the designs of affected components take full advantage of these external projects.

429. The project is not expected to have significant adverse induced impacts, i.e. impacts on areas and communities from unintended but predictable developments caused by a project, which may occur later or at a different location. All components supported by the project are identified as priorities in relevant urban development and sector master plans of the project cities.

430. The planned components in Hue City are in line with the Management Plan of the Complex of Hue Monuments (2015). Improved road conditions supported by the project will improve access to heritage sites, which is a key development objective of the province and a objective of the Management Plan of the Complex of Hue Monuments (2015), and as such will not result in induced (unintended) impacts. A General Planning of Tourism Development in Thua Thien Hue Province for the period 2013 – 2030 was promulgated by Thua Thien Hue People Committee by Decision 1622/ QD-UBND. The General Planning defines objectives and forecast of specific targets and the orientation for tourism development in the province. HMCC has developed a heritage tourism plan as part of the Management Plan of the Complex of Hue Monuments (2015). The impact of tourism activities and development of tourism infrastructure is monitored by HMCC on a six-monthly basis (as defined in the monitoring plan of the Management Plan of the Complex of Hue Monuments (2015). Monitoring results will be reported to ADB through the semi-annual monitoring reports. This is reflected in the EMP for the Hue component.

E. Greenhouse gas emissions

431. The project will generate greenhouse gas (GHG) emissions in a number of ways, including use of fossil fuels and electricity for machinery and vehicles, emissions from vehicles on project roads, and emissions from the WWTP and water supply system operation.

432. The project construction phase is not anticipated to produce large GHG emissions. Road construction is expected to generate GHG emissions of 250-300 t CO_{2eq} per kilometer, primarily from pavement works, and to a lesser extent from earthwork and auxiliary facilities (culverts, lighting etc).[42] Information on GHG emissions from river rehabilitation works could not be found, but are anticipated to be similar those of road construction works. Dredging activities will produce 3-4 kg CO_{2eq} per cubic meter of dredged material, mainly through the use of fuel for the dredging equipment. GHG emissions from drainage, wastewater and water supply network extension or rehabilitation are estimate at t CO_{2eq} per kilometer. Total GHG emissions from project construction are estimated to be in a range from 25,000-50,000 t CO2eq. Operational phase GHG emissions are estimated below.

[42] The World Bank. 2010. Greenhouse Gas Emissions Mitigation in Road Construction and Rehabilitation. A Toolkit for Developing Countries.

433. **Power Usage for water pumping (Hue).** The estimated power usage and greenhouse gas emissions for the water pumping used the following assumptions:[43]

i. Water delivered per year by pump = 18,000 m^3
ii. Average static head for pumping between water treatment plant and service area = 50 m
iii. Small pumps used in the power range 5 - 6 kW each
iv. Power to move 18,000 m^3 of water over a static head of 50 m using small pumps is estimated at 2,700 kWh.
v. Conversion factor of power generation in the Viet Nam grid to greenhouse gas emissions is 0.65 kg CO_{2e}/kWh.

434. On the basis of the assumptions above, power to move the total yearly water to the service area is estimated at 2,700 Kwh and the greenhouse gas emitted by the generation of that power is 1.8 tons CO_{2e} per year.

435. **GHG emissions from WWTP (Vinh Yen).** Lagoon systems treating wastewater have been studied for greenhouse gas emissions in the literature. An indication of gas emissions from stabilization ponds can be found in studies in Europe. Taking average annual figures, the following total yearly emissions are obtained: 1.02 kg/m^2/year CO_2 and 0.312 kg/m^2/year CH_4. The lagoon system is 2.01 ha. Indicative yearly emissions are therefore 20.5 tons CO_2 and 6.3 tons CH_4 (one ton of methane will cause the same amount of warming as 25 tons of CO_2). This provides an indicative total yearly emission for the WWTP of 176 tons CO_{2e}.

436. **GHG emissions from project roads.** The GHG emissions from project roads were established based on the guidance provided in the ADB Environment Safeguards - a Good Practice Sourcebook (2012). If the traffic expressed as passenger car units per day (PCU/day) is below the numbers indicated in Table 80 below in a representative year, the emissions in that year are unlikely to exceed the 100,000 tons CO_2e threshold.

Table 83. Maximum Number of PCU per Km to Trigger 100,000CO2e/a

Length of Road (km)	PCU/day	Length of Road. (km)	PCU/day
10	76,000	50	23,000
20	57,000	60	19,000
30	38,000	70	16,000
35	33,000	90	13,000
40	28,000	100	11,000

Source: ADB Environment Safeguards - a Good Practice Sourcebook (2012)

437. The total length of the proposed roads in this project is 20.5 km, the projected traffic flows in the representative years of 2030 is below 35,000 PCU/day, those are significantly below 57,000 PCU/day traffic for emitting 100,000 tons/a of GHGs.

438. **Greenhouse Gas emission offset.** The project component in Ha Giang will replace 1,900 street lights throughout the city and replace them with LED street lights. LED street lights are very energy efficient, have long life spans (over 20 years), and produce better color and light quality than typical High Pressure Sodium (HPS) street lights. The LED street light retrofit component will result in (i) more even and efficient distribution of light and better quality of light resulting in increased safety; (ii) reduced energy consumption resulting in energy savings and reduced greenhouse gas emissions; and (iii) reduced outages and longer light life spans resulting in reduced maintenance costs. The city expects to save an estimated 4.77 million kilowatt-hours of

[43] Friction losses in pumping have not been used in the calculations.

electricity per year, equivalent to 67% consumption reduction for the 1900 street lights. The retrofit will improve the city's environmental footprint by reducing $CO2_{eq}$ emissions by an estimated 3,100 tons annually.[44]

F. Climate Change Adaptation

1. Climate Risk and Vulnerability

439. The sensitivity of the three city subprojects to climate change was classified as "HIGH" by the AWARE™ software protocol at risk screening stage of the SCDP.[45] The combined HIGH sensitivity of the three cities is from projected sea level rise and onshore storm surge, floods, and landslides. AWARE rating suggests a higher level of risk in relation to floods, landslides, precipitation decrease and sea level rise. Precipitation increase was rated as medium risk by AWARE. Application of the AWARE tool followed the initial Rapid Environment Assessment (REA) of the SCDP as being classified as Medium to High risk for climate change. Given the nature of project components and the climate adaptation measures incorporated in the project design (as described below), the project is considered as "MEDIUM" climate risk category.

2. Present situation (Historical Changes in Climate)

440. **Hue City,** located in the Central Coastal Region of Viet Nam, is sensitive to present-day extreme rainfall events due to the extensive flooding of the low lying city that occurs from the adjacent Huong River and tributaries. Exacerbating rainfall induced-flooding is the effect of storm surge from offshore tropical storms in the nearby Viet Nam Sea that acts to prevent normal seaward flow of the Huong River. The city's stormwater drainage system is often unable to accommodate the surface water run-off during the rainy season, which extends each year from September to February, with particularly high levels of precipitation in October and November. The central area of the city was built on a narrow strip of downstream floodplain of the Huong River. The Citadel area has an elevation of +1.8 msl to +3.5 msl. Phu Hiep and Phu Cat Wards have an elevation of 2.7m to 3.5m. Areas with elevation of less than + 2.0m are frequently flooded. The southern area of the city is on a relatively broad elevation range of +2.5m to +7.5m. There are flat hills in the area between +12.0m and +18.0m, in contrast to local rice fields and lakes/ponds with elevations <+1.5m. According to the elevation and the flooding history, most parts of the city are flood sensitive due to low elevations. In 2013 alone the city experienced five major flood incidents.

441. **Ha Giang City,** located in the Northeast Region of Viet Nam, is also sensitive to extreme rainfall events, however, the mountainous terrain and steep valleys of the Lo and Mien Rivers Ha Giang cause strong flash flooding and high currents contained within the steep river banks. Extraordinary flood waters in the Lo River were recorded in August 1969, August 1971, July 1972, July 1986, April 1989, May 1990, August 1995, July 2000, and September 2014. Erosion of riverbanks on which the city is trying to develop is an ongoing problem for planned urban development. In addition to erosion, landslides and slumping is common along the steep terrain. Ha Giang is not sensitive from sea level rise.

442. Similar to Hue, the entire city of **Vinh Yen City** (located in the Northern Delta Region) is at a low elevation situated in the lower basins of two rivers and thus currently is sensitive to severe

[44] An electricity-specific emission factor of 0.65 kgCO2/kWh is assumed for the Viet Nam electricity grid.

[45] The AWARE model is a tool to assess climate change sensitivity of proposed infrastructure projects. The software combines geographic information on current site-specific climate, climate hazards from topography, elevation, & distance to ocean, and the latest climate change projections for each area.

rainfall events which cause broad flooding from the Lo and Phan River basins. The Phan River basin was flooded in 20 out of 25 years with 1 to 3 times of waterlogging per year. The Dam Vac Lake overflows when the water level reaches 8.5-9 msl. In the last 45 years, the lake's water level has exceeded 8.5 m six times, and 9 m four times. Vinh Yen City and neighboring area have about 180ha of frequently-flooded area. Particularly, several residential areas in the city center are usually flooded from 0.2m to 0.5m in heavy rains. Some suburban residential areas including Dam Coi, Quan Tien, Vinh Quang (Thanh Tru), and Lac Y (Dong Tam) are isolated when the flood water in Phan River is high.

443. The strong sensitivities to present climate pre-dispose the three subproject cities to be sensitive to projected climate change.

3. Climate Change Trends and Projections[46]

(1) Historical Climate Trends

444. In the period of 1958-2014, temperatures show increasing trends in most areas of Viet Nam. The annual average temperatures increased by about 0.62°C for the whole country, (about 0.10°C/decade). Daily maximum and minimum temperatures show increasing trends with the highest rate of up to 1°C/decade. The number of hot days (days with T ≥35°C) increased in most regions of the country, especially in the Northeast, the Northern Delta and the Central Highlands with an increase of about 2-3 days/decade; while the number of hot days decreased in some stations in the Northwest, South Central and the South.

445. Annual rainfall had decreasing trends in the northern regions (5.8%-12.5% over 57 years) and increasing trends in the southern region (6.9%-19.8% over 57 years). Extreme rainfall trends varied between climate zones, decreasing in most stations in the Northwest, Northeast, Northern Delta and increasing in a large number of stations in other climate zones.

446. The number of typhoons and tropical depressions in the East Sea that directly affected or made landfall in Viet Nam show little change in the 57-year period. However, the number of strong typhoons (maximum sustained winds of 33 m/s or higher) had a slight upward trend in recent years, typhoon seasons ended later and there was an increased trend of typhoons making landfall in the South.

447. Sea levels in Viet Nam increased by about 2.45 mm/year in the period 1960-2014; and about 3.34 mm/year in the period 1993-2014. According to satellite data, sea levels increased by 3.5±0.7 mm/year in the period 1993-2014. The greatest increase in average water level was found along the coast of Central Viet Nam (4 mm/year). The lowest increase in average water level was observed in the Northern Gulf coast (2.5 mm/year).

(2) Climate Change Projections

448. Scenarios of climate change and sea level rise for Viet Nam were updated in 2016 following the roadmap defined in the National Strategy on Climate Change, providing the latest information on the trends of climate change and sea level rise in recent years, as well as climate change and sea level rise scenarios for Viet Nam in the 21st century. The climate change and

[46] This section is mainly based on the report "Climate Change and Sea Level Rise Scenarios for Viet Nam", issued by the Viet Nam Ministry of Natural Resources and Environment in 2016.

sea level rise scenarios are built upon the 5th assessment report (AR5) of the Intergovernmental Panel on Climate Change (IPCC); observed hydro-meteorological and sea level data till the year 2014, and digital national topographic maps updated till 2016; recent changing trend of climate and sea level in Viet Nam; global and regional climate models with high resolution for Viet Nam, and coupled atmosphere-ocean models, amongst others.[47]

449. **Temperature:** For the RCP4.5 scenarios, surface temperatures are projected to increase by 1.9-2.4ºC in the North and 1.7-1.9ºC in the South. For the RCP8.5 scenarios, temperature would increase by 3.3-4.0ºC in the North and 3.0-3.5ºC in the South. Extreme temperatures would have an upward trend (Table 82).

450. **Precipitation:** For the RCP4.5 scenarios, annual precipitation is projected to generally increase in a range of 5-15%. For the RCP8.5 scenarios, the greatest increase would increase by over 20% in most of the North, Central Coast, a part of the South and Central Highlands. Average maximum 1-day rainfall would increase all over Viet Nam (10-70%) compared to the reference period (Table 83).

451. **Monsoon and climate extremes:** The number of strong and very strong typhoons has an upward trend. The time of the beginning of the summer monsoon is projected to start earlier and end later. Monsoon rainfall would have an increased trend. The number of hot days (T ≥ 35°C) is projected to increase, the largest increase expected in the North Central Coast, South Central Coast and Southern Viet Nam.

452. **Sea level rise:** By 2050, average sea level rise for the coastal areas of Viet Nam are about 22 cm for the RCP4.5 scenarios and about 25 cm for the RCP8.5 scenarios. By 2100, average sea level rise for the coastal areas of Viet Nam would be about 53 cm for the RCP4.5 scenarios and about 73 cm (49÷103 cm) for the RCP8.5 scenarios. An increase of sea level by 50-70 cm would result in 0.93-2.59 of Thua Thien Hue Province inundated.

Table 84: Changes in average annual temperature (ºC) compared to the period 1986-2005[48]

Province	RCP4.5 scenarios			RCP8.5 scenarios		
	2016-2035	2046-2065	2080-2099	2016-2035	2046-2065	2080-2099
Ha Giang	0.6 (0.1-1.1)	1.7 (1.1-2.5)	2.3 (1.5-3.5)	1.1 (0.6-1.6)	2.2 (1.5-3.3)	3.9 (3.1-5.8)
Vin Phuc	0.7 (0.3-1.1	1.7 (1.2-2.5)	2.4 (1.7-3.5)	1.1 (0.6-1.7)	2.3 (1.4-3.4)	3.9 (2.9-5.8)
Thua Thien - Hue	0.7 (0.4-1.1)	1.4 (0.9-2.0)	1.9 (1.3-2.7)	0.8 (0.6-1.2)	1.9 (1.3-2.6)	3.3 (2.6-4.5)

Source: MONRE. 2016. Climate Change and Sea Level Rise Scenarios, Summary for Policy Makers.

Table 85: Changes in annual precipitation (%) compared to the reference period[49]

Province	RCP4.5 scenarios			RCP8.5 scenarios		
	2016-2035	2046-2065	2080-2099	2016-2035	2046-2065	2080-2099
Ha Giang	5.8 (2.7-8.9)	7.8 (3.1-12.6)	11.8 (5.0-19.0)	-3.3 (-9.6-3.3)	4.0 (-0.2-8.1)	12.7 (6.6-18.8)
Vin Phuc	14.8 (5.4-24.6)	18.2 (10.6-26.6)	22.4 (12.5-34.1)	10.7 (4.7-17.0)	22.2 (12.4-32.1)	30.8 (18.5-42.1)
Thua Thien - Hue	17.0 (10.4-23.6)	22.5 (10.7-34.3)	26.2 (15.4-38.1)	16.5 (9.0-23.3)	18.6 (12.9-23.9)	21.2 (13.8-28.2)

Source: MONRE. 2016. Climate Change and Sea Level Rise Scenarios, Summary for Policy Makers.

[47] MONRE. 2016. Climate Change and Sea Level Rise Scenarios, Summary for Policy Makers.

[48] Values in parentheses are the 10% and 90% confidence levels around the mean values)

[49] Ibid

4. Contribution of SCDP to Enhanced Climate Resilience

453. The rationale for selecting project activities and components and the decided focus of the engineering designs of the components in each city has been primarily enhanced resilience to climate change. The SCDP will contribute to increased urban climate resilience in the three cities along three avenues (Table 84). Firstly, the SCDP will directly support activities and subcomponents predicated on the need for adaptation to climate change. These activities and subcomponents were identified in government climate adaptation strategies and plans. Secondly, climate proofing of component infrastructure has been incorporated at the feasibility design which will be further refined at detailed design stage. These activities classify as Type 1 activities per ADB guidance. And thirdly, grant financing will be provided through piggy-bag technical assistance to support smaller community-based climate proofing initiatives and help climate proof detailed design, amongst others.

454. These contributions are described in more detail below. In total, the project's financial contribution to promoting climate resilient urban development is estimated at $29.16 million. This excludes contributions through piggy-bag TAs financed by the UCCRTF and GEF (amounting to $4 million and $1.91 million, respectively).

b) Contribution to Government Climate Adaptation Plans (Type 2 Activities)

455. The project has selected components and activities that were identified by the governments of Vinh Phuc Province and Hue City as priority actions to increase urban climate resilience. Some components were defined in the Green City Action Plans (2014) developed for and endorsed by the three cities. These subprojects classify as Type 2 activities per ADB guidance[50] and described below.

(1) Hue

456. The SCDP directly supports some of the activities and projects defined in the “Climate Action Plan for Hue City, Responding to Climate Change from 2014-2020 (CAP)”. The CAP has identified the need to upgrade and dredge the drainage system and runoff retention lakes in the Citadel area as key climate resilience actions for the period 2014-2020. As defined in the CAP, the activity's objectives are to (i) restore flood drainage and flood retention capacity of existing infrastructure; and (ii) contribute to protection and stability of Citadel heritage structures. Six climate resilient components of the project output in Hue that directly address the objectives of the CAP, include: (i) Drainage and Pavements in Four Wards; (ii) Dredging and Embankments of Citadel Lakes; (iii) Dredging and Embankment of Ke Van River; (iv) Dredging and Embankment of An Hoa River; (v) Dredging and Embankment of Dong Ba River; and (vi) Dredging and Embankment of Lap River.

457. The SCDP also supports activities defined in the “Green City Action Plan for Hue City (2014) (GCAP)” that will improve drainage in the Citadel, and reduce flooding. The proposed activities of GCAP include: (i) Improve Drainage System of Citadel and City; and (ii) Rehabilitate Ponds and Canals of Hue.

[50] ADB. 2016. Guidance Note on Counting Climate Finance in Urban and Water.

(2) Vinh Yen

458. The SCDP directly supports some of the activities and projects defined in the Vinh Phuc Climate Adaptation Plan 2015-2030 (VPCA). The VPCA has identified the dredging of the Dam Vac Lake as the provincial priority to increase Vinh Yen's climate resilience. The SCDP supports the “Green City Action Plan for Vinh Yen (2014)” which also identified dredging of Dam Vac Lake as an important intervention to increase the city's resilience to climate change. Dredging of the lake is a key urban priority for climate resilience to reduce flooding and make the adjacent low lying areas of Thanh Tru, Nga Ba Tam Duong, and Lien Bao more resilient to climate change.

(3) Ha Giang

459. As of late 2016 Ha Giang did not have a strategic plan to address climate change. The Green City Action Plan for Ha Giang (2014) has identified a number of initiatives that will increase the resilience of the city to climate change. Some of these activities are shared by the SCDP which include embankment works along the Lo and Mien rivers. However, these are not predicated on the need for adaptation to climate change and as result are not classified as Type 2 activities.

c) Climate Proofing of Project Infrastructure

460. The subproject components are being designed at the outset to be resilient to the impacts of present-day climate extremes, defined primarily by rainfall intensity flooding, sea storm surge, erosion, and landslip. Within the context of limited budgets this means that most of the subproject components are vulnerable to the projected changes in climate, and justify climate proofing.

461. The sensitive attributes of the components consist of for example; (1) embankment height; (2) park lands lateral drainage capacity; (3) stream-drain flow capacity; (4) capacities of combined waste-stormwater and water supply networks; and secondarily (5) road bed grade, elevation and pavement type and road drainage. By example these design factors must be resilient to climate change for the individual components to be sustainable without premature, major retrofits.

462. The designs and approaches to climate proofing the different subcomponent infrastructures at the different subproject sites are detailed in the Feasibility Study Reports.[51] Provided below is a summary of the key design criteria for climate proofing. Detailed design will be supported through a GEF grant to ensure that climate proofing of project infrastructure, where required, will be incorporated into detailed design (refer to discussion on GEF grant further below).

(1) Embankment Developments

463. The heights of the new and restored embankments along the lakes & rivers (canals) at the Citadel and An Cuu and Nhu Y Rivers in Hue, the Lo and Mien Rivers in Ha Giang, and along Dam Vac Lake in Vinh Yen were set to accommodate anticipated future increase in flood levels. The embankment slopes will moderate water velocity as levels rise, and structure materials of the embankments will prevent fast water erosion. Moreover, pursuant to the three city GCAPs, the embankment slopes and top promenades incorporate vegetation ranging from trees to hardy shrubs to provide more natural erosion protection and flood moderation. This will be further detailed during the detailed design stage with support of the GEF grant.

[51] Footnote #8

(2) Parkland Development

464. The green parks to be constructed south of Hue and central Vinh Yen have been designed at elevations to not be susceptible to seasonal flooding that occur at both locations. In particular are the flood levels of the adjacent Dam Vac Lake in Vinh Yen, and the large agricultural-suburban area of An Duong. The parks will include lateral drainage to prevent ponding in the middle of the large lakes, and will have erosion resistant peripheral zones to maintain the boundary integrity of the parkland areas. In support of the GCAPs, the parks will support abundance planted vegetation including trees and shrubs which together will also moderate the impact of heavy rainfall events.

(3) Stream-drain Rehabilitation

465. The primary design criterion of the rehabilitation of stream drains in Ha Giang is to restore natural flow capacity and the vegetated stream banks, and to ensure the box culverts placed in key locations have the capacity for increased stream flow. Embankment erosion will be managed with the restored vegetated banks along with proper sized culverts at the outfalls of the streams, and along stream reaches between buildings. This will be further detailed during the detailed design stage with support of the GEF grant.

(4) New Wastewater Networks & Treatment, and Water Supply

466. The capacity of the new closed and open combined storm-wastewater networks in Vinh Yen are designed to accommodate anticipated increased extreme rainfall events and runoff, as well as population growth. Pipe and open drainage ditch diameters have been specified accordingly. The capacity of the new wastewater treatment plant southwest of the city will be able to accommodate future treatment demand.

467. Conversely, the new water supply to the villages southwest of Hue will accommodate projected drier dry seasons in Viet Nam. Based on consultations of villagers, dry season availability of groundwater has been significantly reduced in recent years, which is the rational for the new water supply. The supply from the WTP will be able to provide enough dry season water to the villages. Also, the alignment and footings of the above ground pipeline will be placed in areas where the pipeline will not be vulnerable to local stream or river washouts. This will be further detailed during the detailed design stage with support of the GEF grant.

(5) New and Upgraded Roads, Drainage, & Bridges

468. While not included with the suite of subproject components for climate resilient development, the new and upgraded roads in all three cities have been designed to be resilient to climate change. The key design criteria are: (1) road bed grades that are high enough to not be vulnerable to lateral flooding from adjacent water courses (e.g., Lo River in Ha Giang & Huong River in Hue) or lowlands; (2) sufficient cross drainage to prevent lateral ponding and flooding; (3) road bed aggregates that shed water and are resistant to erosion; and (4) asphalt grades that do not absorb water with adequate shoulder drainage from road crowns. This will be further detailed during the detailed design stage with support of the GEF grant.

d) Urban Climate Change Resilience Fund (UCCRTF)

469. The UCCRF ($4 million) will support small scale community-based climate proofing initiatives in Hue and Vinh Yen. Activities focus on conducting climate resilience assessments to identify the community risks and vulnerabilities to climate change, and at the same time raise

awareness of climate change and understand what climate change means at the community household level.

470. Workshops with individual households, ward representatives, and mass organizations will be held to understand how climate influences community life, and the priorities and costs of attaining climate resilience. An outcome of the workshops in Hue and Vinh Yen will be a Community Resilience Plan (CRP) which highlights community life sensitivities to climate change and an action plan to create resilience. The CRP will also identify early warning strategies to warn and respond to the onset of severe climate events before they fully happen.

471. As a part of the CRPs, small-scale climate resilience measures will be identified and implemented. These measures will respond to the needs of the local communities and can include the types of activities listed below. The SCDP is contributing to some of these initiatives at a larger scale:

- Community water supply for the urban poor that extends municipal water supply with regulated water vendors;
- Rain water harvesting to better manage shortfalls water supply systems enabling households to access clean water;
- Community based flood management at three broad types of activities: (i) advance preparation; (ii) real-time responses; and (iii) post-flood rehabilitation;
- Small-scale renewable energy technologies, such as micro-wind, biogas or solar-powered lanterns.

472. The UCCRTF-funded piggyback TA will also analyze financial viability and benefits of new climate risk finance (i.e. climate insurance) for Hue, one of the first cases in Viet Nam, and will be assessed its future application in Viet Nam.

e) GEF Grant

473. A GEF grant of $1.91 million will be provided to the three project cities to demonstrate environmentally-friendly and climate resilient urban development. An integrated urban planning approach, incorporating green and climate resilience, will be promoted and institutionalized using the GEF funded piggyback TA. The TA component will (i) develop recommendations for greening and increasing the climate resilience of SCDP investments for Ha Giang, Hue and Vinh Yen; and (ii) demonstrate urban resilience investments. The grant will include two main set of activities, including:

(A) Greening and Climate Resilience of SCDP loan investments:

- Provide direct technical advice to the detailed engineering design of SCDP investments in Ha Giang, Hue and Vinh Yen.
- Provide recommendations for incorporating greening and increasing the climate resilience of the engineering design.
- Identify and recommend opportunities for greening the supply chain in the procurement of SCDP investment and demonstration projects.
- Assist with modifications or adjustment to procurement packages relative to resilience design, greening the projects, greening the supply chain or revised budget estimates and selection criteria.

(B) Urban Resilience Demonstration Projects – Design and Implementation:

- Design and implement demonstration projects identified to ensure climate proofing, using green supply chain and procurement principles.
- Document lessons learnt from climate-proofing demonstrations.

Table 86. Estimate of contribution of SCDP to urban climate finance (adaptation)

	1	2	3	4	5	6	7
Project subcomponents in the 3 project cities	**Total Costs of sub-components (USD)**	**Included in provincial government action plan as priority action for urban climate resilience**	**Included in Green City Action Plan as climate resilience initiative**	**Not in (2) or (3), but considered climate resilience activity by SCDP**	**Climate Proofing of Infrastructure considered**	**Adaptation activity typology, ratio of adaptation finance (%)**	**Projects' contribution to Climate Resilience and Climate Proofing (USD)**
	(Note 1)	*(Note 2)*	*(Note 3)*	*(Note 4)*	*(Note 5)*	*(Note 6)*	*(Note 7)*
Hue							
Drainage and Pavement in 4 Inner City Wards of Citadel	9.50	✓	✓		✓	Type 2 (100%)	9.50
Dredging and Embankments of Citadel Lakes	2.06	✓	✓		✓	Type 2 (100%)	2.06
Dredging and Embankments of Ke Van river	1.87	✓			✓	Type 2 (100%)	1.87
Dredging and Embankments of An Hoa river	3.66	✓			✓	Type 2 (100%)	3.66
Dredging and Embankments of An Dong Ba river	0.56	✓			✓	Type 2 (100%)	0.56
Dredging and Embankments of Lap river	0.92	✓			✓	Type 2 (100%)	0.92
(Climate proofing of) Rehabilitation/ Embankment of An Cuu River	0.47				✓	Type 1 (5%)	0.02
(Climate proofing of) Rehabilitation/ Embankment of Nhu Y River (Vi Da Bridge on Han Mac Tu Road to Van Duong)	0.49				✓	Type 1 (5%)	0.02
Water Supply System to Pho Son Waste Facility and Villages	0.83			✓		Type 2 (25%)	0.21
(Climate proofing of) Park, Path, Drainage, and Lighting	5.60				✓	Type 1 (2%)	0.28

	1	2	3	4	5	6	7
Project subcomponents in the 3 project cities	**Total Costs of sub-components (USD)**	**Included in provincial government action plan as priority action for urban climate resilience**	**Included in Green City Action Plan as climate resilience initiative**	**Not in (2) or (3), but considered climate resilience activity by SCDP**	**Climate Proofing of Infrastructure considered**	**Adaptation activity typology, ratio of adaptation finance (%)**	**Projects' contribution to Climate Resilience and Climate Proofing (USD)**
	(Note 1)	*(Note 2)*	*(Note 3)*	*(Note 4)*	*(Note 5)*	*(Note 6)*	*(Note 7)*
in An Van Duong Development Area							
(Climate proofing of) Park and Square in the Administrative Area	4.84				✓	Type 1 (2%)	0.24
(Climate proofing of) 100 m Road connecting Urban Area A and B in An Van Duong Development Area (bridge crossing Nhu Y River)	2.27				✓	Type 1 (3%)	0.07
(Climate proofing of) Bui Thi Xuan Road	2.87				✓	Type 1 (3%)	0.14
(Climate proofing of) Huyen Tran Cong Chua Road	1.95				✓	Type 1 (3%)	0.06
(Climate proofing of) Vi Da Bridge and Access Road	2.64				✓	Type 1 (3%)	0.08
Vinh Yen							
Embankment & Dredging of Dam Vac lake	6.88	✓	✓		✓	Type 2 (100%)	6.88
(Climate proofing of) Collection and Wastewater Treatment (West) Vinh Yen Phase 2	18.53				✓	Type 1 (2%)	0.37
(Climate proofing of) Tertiary Wastewater System in Four Wards of Dong Da, Ngo Quyen, Khai Quang and Lien Bao	5.48				✓	Type 1 (5%)	0.274
(Climate proofing of) Green Park Development South of Dam Vac Lake	14.57				✓	Type 1 (5%)	0.73

	1	2	3	4	5	6	7
Project subcomponents in the 3 project cities	**Total Costs of sub-components (USD)**	**Included in provincial government action plan as priority action for urban climate resilience**	**Included in Green City Action Plan as climate resilience initiative**	**Not in (2) or (3), but considered climate resilience activity by SCDP**	**Climate Proofing of Infrastructure considered**	**Adaptation activity typology, ratio of adaptation finance (%)**	**Projects' contribution to Climate Resilience and Climate Proofing (USD)**
	(Note 1)	*(Note 2)*	*(Note 3)*	*(Note 4)*	*(Note 5)*	*(Note 6)*	*(Note 7)*
(Climate proofing of) Infrastructure for University Area	8.34				✓	Type 1 (3%)	0.25
Exhibition/Linkage Center for Business Support	1.77						0
Ha Giang							
(Climate proofing of) Rehabilitation of Main Drainage Lines in Minh Khai Ward	2.91				✓	Type 1 (5%)	0.15
(Climate proofing of) Rehabilitation of Main Drainage Lines in Tran Phu Ward	2.82				✓	Type 1 (5%)	0.14
(Climate proofing of) Rehabilitation of Main Drainage Lines in Quang Trung Ward	0.61				✓	Type 1 (5%)	0.03
(Climate proofing of) Western embankment of Lo river	2.57				✓	Type 1 (5%)	0.13
(Climate proofing of) Embankment on both sides of Mien river	8.09				✓	Type 1 (5%)	0.40
(Climate proofing of) Southern Embankment of Me Stream	1.24				✓	Type 1 (5%)	0.06
Upgrading of National Road No. 2	1.72						0
Southern Ring Road Improvement	4.58						0
(Climate proofing of) Phung Hung Road	2.12				✓	Type 1 (3%)	0.06

	1	2	3	4	5	6	7
Project subcomponents in the 3 project cities	**Total Costs of sub-components (USD)**	**Included in provincial government action plan as priority action for urban climate resilience**	**Included in Green City Action Plan as climate resilience initiative**	**Not in (2) or (3), but considered climate resilience activity by SCDP**	**Climate Proofing of Infrastructure considered**	**Adaptation activity typology, ratio of adaptation finance (%)**	**Projects' contribution to Climate Resilience and Climate Proofing (USD)**
	(Note 1)	*(Note 2)*	*(Note 3)*	*(Note 4)*	*(Note 5)*	*(Note 6)*	*(Note 7)*
Bridge from National Road No. 2 to Southern Ring Road	4.03						0
TOTAL	**126.79**						**29.16**

Note 1: Represents base costs plus tax for works only.
Note 2: Components listed as priority investments in Government Climate Action Plans (for Hue and Vinh Yen only) – classifying as Type 2 activities.
Note 3: Components listed in the Green City Action Plans which specifically target increased urban climate resilience – classifying as Type 2 activities.
Note 4: Includes activities not prioritized in (2) or (3), but considered climate resilience activity by SCDP processing team and Government.
Note 5: Classifying as Type 1 activities. Assumed 3-5% for components which are or will be climate proven at detailed design stage. These are estimates based on similar climate proofing interventions in other ADB projects. Final figures will be available once detailed design is complete.
Note 6: Type 1 and Type 2 as defined in Guidance Note on Counting Climate Finance in Urban and Water (ADB, 2016).
Note 7: Double counting of (2) to (5) is avoided.

VII. INFORMATION DISCLOSURE AND PUBLIC GRIEVANCE REDRESS MECHANISM

474. The subproject components were introduced to affected stakeholders and the public during the public consultations with verbal and visual presentations of the subproject components. The VODA, the HDPI, and the HCPC, and their project management and construction supervision consultants (for HDPI and HCPC) and safeguards and social monitoring consultant (for VODA) will be responsible for public participation during project detailed design and implementation. These plans 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 project is completed. These plans will include several types of public involvement, including site visits, workshops, investigation of specific issues, interviews, and public hearings. The cost for public consultation and participation during project implementation will be borne by the project management and construction supervision consultants (for HDPI and HCPC) and safeguards and social monitoring consultant (for VODA). Public consultation plans are defined in the three EMPs prepared for each city.

475. The formal disclosure of subproject information in local language to affected persons and stakeholders that occurred during the development of the IEE is meant to form the beginning of continued information disclosure and stakeholder involvement as the project is implemented. This IEE will be disclosed on the project website. The executive summary of the IEE will be translated into the Vietnamese language and distributed to all affected persons. As part of the stakeholder communication strategy developed for the IEE, regular information exchange meetings with stakeholders are required throughout implementation of the subprojects.

476. The IEE will be available on the websites of the three Provincial Peoples Committees (PPC), at PPC offices, on the websites of the subproject PMUs (DPI in Hue, CPC in Ha Giang, and ODA Board of PPC in Vinh Yen), and at subproject office sites. Similarly, all environmental reporting on the three subprojects with specific reference to stakeholder consultation minutes, environmental monitoring, and reports on EMP implementation released by the EA/IU/PMUs will be available at the same offices and from same websites. After implementation of the three subprojects begins, all environmental and EMP reporting submitted by the EA/PMUs will also be available on the ADB website.

2. The VODA, the HDPI and HCPC on behalf of the VPPC, the HUPPC and the HAPPC have agreed on the following reporting commitments: (i) submission of periodic progress reports during project implementation; (ii) submission of semiannual integrated safeguards monitoring reports, covering resettlement activities, EMP implementation, (iii) submission of GAP and SDAP implementation progress reports; (iii) submission of project completion report three months after completion of the project. The following table summarizes the key reporting requirements during project implementation. All reports will be disclosed.

Table 87. Key Reporting Requirements for Environment

Report	Reference	Timing of Reporting	Responsible Agency
Project Progress Report			
- Reporting of baseline and progress data including environmental management plan	Project Agreement	- Semiannual (January–June and July–December) in July and January	- The VODA, the HDPI and HCPC (and the PMCS)
Environmental Report			
- Periodic safeguards report including environment monitoring and EMP during the construction phase - Environment monitoring during the operation phase	Project Agreement	- Semiannual (January–June and July–December) in July and January	- The VODA, the HDPI and HCPC (and the PMCS and SSM)
Project Completion Report			
- Reporting on overall implementation after the subproject completion, including on EMP implementation	Project Agreement	- Not later than three months after the physical completion of the sub project	- The VODA, the HDPI and HCPC (and the PMCS and SSM)

A. Grievance Redress Mechanism

477. A clear and easily accessible grievance redress and resolution mechanism has been prepared to assist affected persons (AP) with issues or complaints regarding the subproject in their city. These GRMs have been developed in coordination with the project PMUs as well as the provincial DONREs. All APs will be made fully aware of their rights, and the detailed procedures for filing grievances, and the appeal process. The GRM shall be published and disseminated through an effective public information campaign during the detailed design-preconstruction phase. The grievance redress mechanism and appeal procedures will be distributed to all APs in a project information booklet (PIB).

478. Directly APs are entitled to lodge complaints regarding any aspect of affected environments, land acquisition and resettlement requirements such as, noise, pollution, entitlements, rates, and payment and procedures for resettlement and income restoration programs. APs complaints can be made verbally to construction contractors for environmental annoyances or in written form.

1. Oversight of GRM

479. The three subproject IA/PMUs will take the leading roles in the application of the GRM process that is described below. The PMU offices will receive, log, and initiate required actions to resolve grievances. In this way the concerns of affected persons are closely linked to the implementation of the subprojects at no cost or retribution to the affected persons. The GRM shall make use of the existing legal procedures of GOV.

480. As indicated above the subproject PMUs shall make public the existence of the GRM through public awareness campaigns. The PMUs shall establish a 24-hour hotline for complaints and the hotline shall be publicized through the media. Names and contact numbers of representatives of the PMUs, and contractors tasked to receive complaints shall be placed on the notice boards outside every construction site. Locally affected people may express grievances through the ward/commune or district committees, however by design these are immediately forwarded to the PMUs.

481. The legal basis and formal procedure for the GRM for environment is established in the following legislation:

- Law No 02/2011/QH13 on Complaints and Decree No. 75/2012/ND-CP detailing a number of articles of the law on complaints
- Law No 03/2011/QH13 on Denunciations
- Law No 55/2014/QH13 on Environmental Protection

482. Based on Article 143 of Law No 55/2014/QH13, the District People's Committee (DPC), Provincial People's Committee (PPC), and Ministry of Natural Resources and Environment (MONRE) have functions and responsibilities to receive and resolve complaints.

483. Based on Law 02/2011/QH13, the first step in GRM is to contact the ward/commune PC, the second step the City PC, and third step the Province PC. MONRE has also responsibility to receive and resolve complaints as the first step for its official decisions or administration actions of officers and staff under MONRE's direct management. The scope of this law is for official decisions and administration actions of government agencies and officers.

2. Current GRM in the three cities

a. Ha Giang and Hue

484. APs can send any question to implementation agencies about their rights in relation with land acquisition, environmental problems, compensation. APs will not be ordered to pay any fee for resolving their grievance and complaints at local levels and court. The following steps for grievance redress are established based on the Complaint Law No. 02/2011/QH13, dated 11/11/2011 and Degree No 75/2012/NĐ-CP on November 20, 2012. A complaint is handled through three stages, if not solved, it can be sent to court as a final level.

First Stage: Ward/Commune Peoples' Committee (W/CPC)

485. An AP may lodge his/her complaint before any member of the W/CPC through the residential group leader or directly to the W/CPC, in written or verbal form. It is incumbent upon the village chief to notify the CPC about the complaint. The W/CPC will meet personally with the aggrieved AP and will have 15 days to respond to the complaint. The W/CPC secretariat is responsible for documenting and keeping file of all complaints that it handles.

Second Stage: City People's Committee (City PC)

486. If after 15 days the aggrieved AP does not hear from the W/CPC, or if the AP is not satisfied with the decision taken on his/her complaint, the AP may bring the case, either written or verbal, to any member of the City PC. The City PC has 10 days to respond to the complaint. The City PC is responsible for documenting and keeping files of all complaints that it handles.

Third Stage: Province People's Committee (PPC)

487. If after 10 days the aggrieved AP does not hear from the City PC, or if the AP is not satisfied with the decision taken on his/her complaint, the AP may bring the case, either in writing or verbal, to any member of the PPC. The PPC has 10 days within which to respond to the complaint to the satisfaction of all concerned.

Final Stage: People's Court

488. If after 10 days following the lodging of the complaint with the PPC, the aggrieved AP does not hear from the PPC, or if he/she is not satisfied with the decision taken on his/her complaint, the case may be brought to the people's court.

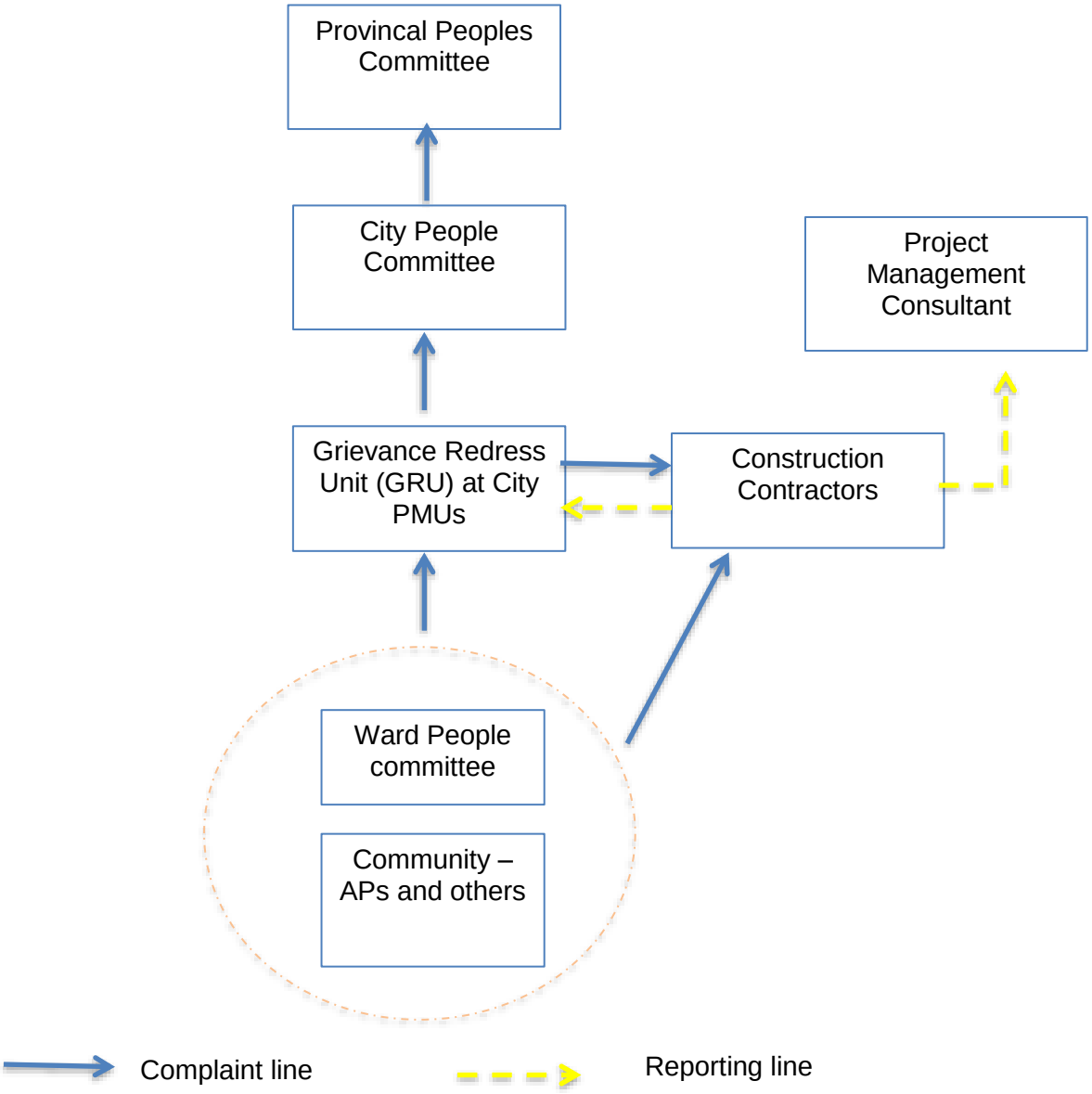
b. Vinh Yen

489. The single significant difference with a GRM in Vinh Yen is that a GRM Unit is/can be established within a Vinh Yen PMU to initially receive and handle AP complaints. If after 10 days the aggrieved AP has not heard from the GRM Unit, or if the AP is not satisfied with the decision taken on his/her complaint, the AP may bring the case, either written or verbal, to any member of City PC at the second stage of the normal GRM described above. This central role of the PMU at the initial stage of grievance resolution is desired for the GRM of the SCDP. The PMU becomes the Grievance Redress Unit (GRU) for overseeing grievances and the GRM.

3. Proposed GRM for the SCDP

490. The City PMUs will play a central role in the coordination of the city-level GRMs. Each PMU will establish a central GRM unit composed of relevant PMU project staff, subject to approval by the PPCs. Decision making is done by PPC involving relevant stakeholders. With decisions taken at the highest level, there is no need for appeals except if complainants choose to use the court systems should they not agree with the proposed resolutions. The proposed GRM for the SCDP is shown in Figure 75.

Figure 75. Proposed GRM for SCDP (City-level)



a. Roles and Responsibilities

491. The GRU will be composed of a GRU head, a resettlement specialist, an environment specialist, and possibly staff from the administration unit.

492. The W/CPC and/or complainants will: (i) draft a written complaint to be signed by the complainant indicating name of complainant, date and address of the complainant, description of complaint and supporting documents, if any; and (ii) send the complaint to the GRU. They also may participate in GRM meetings, and provide relevant information related to the submitted complaints as required.

493. The GRU will: (i) receive all complaints from people seeking access to the GRM and promptly acknowledge them (within 5 working days); (ii) register the complaints; (iii) determine eligibility of a complaint; (iv) screen and forward the complaint to contractors if required; (v) coordinate and monitor activities by contractors; (vi) track and record all actions taken by the GRC, (vi) provide information and feedback to W/CPC and complainants, (vii) maintain a complaint registration and tracking system.

b. GRM Procedures

Stage 1: Access to the GRM.

494. If a concern arises, the complainant will make his/her complaint known to the Ward/Commune People's Committee (W/CPC) or to the grievance redress unit (GRU). Complaints can also be sent directly to the contractor through the hotline number provided for construction related matters such as noise, dust and other emergency matters which require immediate action. Contractors are required to report back to the GRU as well as the Construction Supervision Consultant on complaints received and resolved within one week. For more complex construction matters, the GRU will forward the complaint to the contractors with recommendations for action.

Stage 2: Submission and Registration.

495. The W/CPC or complainant will submit a written or verbal complaint to the GRU. (In case a complaint is filed with the contractor but can't be resolved by the contractor, the contractor shall inform the complainant to contact the GRU to ensure the complaint is properly filed).The GRU will register the complaint. The GRU will register the complaint in the grievance registry and issue an acknowledgement of receipt within 5 working days of the complaint with information on when a decision will be made regarding the complaint. The GRU will handle all questions and queries of project related activities.

Stage 3: Determine Eligibility.

496. The GRU will determine whether the complaint is eligible for the grievance mechanism. A screening procedure based on simple eligibility criteria will be established for the GRU. Criteria include: (i) the complainant can demonstrate that he/she is negatively affected by the project; (ii) in case of representation, the complainant has a valid representation authoritization; (iii) the complaint relates to environmental or social safeguards aspects of the project. If the complaint is deemed ineligible, the complainant is informed of the decision and the reasons for ineligibility. A

response on the eligibility shall be given to the complainant within 10 working days after receipt of the complaint.

Stage 4: Assessment and Decision on Action.

497. If the complaint is eligible, the GRU will inform the complainant within 10 working days after receipt of the complaint that his/her complaint is eligible, including indication of the grievance assessment process and timeframe. The GRU, with support of relevant authorities, will conduct an assessment and gather information about the complaint and key issues and concerns to determine how the complaint might be resolved. The W/CPC and community members will participate in the assessment as necessary. If outside experts or technical information is needed, the GRU may seek such guidance and may request all parties concerned to participate in the GRM process. The decision on the solution will be by the PPC. The GRU will develop an action plan and identify responsibilities for the plan. This action plan will be reported directly to the complainant and/or W/CPC through the GRU. The response shall not be submitted later than 30 days after receipt of the complaint. If this timeframe cannot be ensured, the complainant shall be informed accordingly prior to the deadline of 30 days.

Stage 5: Implementation of Actions.

498. Implementation of the action plan commences with close collaboration of relevant project stakeholders depending on the type of complaint.

Stage 6: Monitoring and Reporting on Implementation.

499. The GRU will monitor the implementation of actions and record. As part of the monitoring process, the GRU will consult the relevant project stakeholders, as needed. The monitoring time frame will be complaint-specific depending on the implementation of the actions.

Stage 7: Closure of the Complaint.

500. When complaint redress and monitoring is completed, the GRU will prepare a final report which is shared with the complainant and W/CPC, and filed. The complainant will confirm completion of the actions and agree to the closure of the complaint. The grievance dossier is closed and filed in the project archive.

4. Complaint Monitoring and Evaluation

501. All grievances, concerns and complaints received will be entered into a complaint tracking system that will allow complaints to be tracked and monitored with sufficient details. Monitoring information will include the following data organized by type and location:

- number and type of complaints received
- number and % of complaints that have reached agreement
- number and % of complaints that have been resolved
- number and % of complaints that are unresolved

502. The GRU will review the data on a quarterly basis to evaluate the functionality of the system, as well as to note the following:

- Failures to follow GRM procedures

- Delays in complaint resolution, particularly those that can affect project construction
- Most frequent types of grievances and complaints
- Location(s) producing the most grievances and complaints

VIII. CONCLUSIONS AND RECOMMENDATIONS

503. The SCDP will provide significant improvements to urban infrastructures of the three subproject cities. The explicit landscaped and “green” design elements will contribute greatly to the water management function of the infrastructures, while contributing the green city action plans of the cities.

504. The SCDP will increase resilience to present climate/weather extremes, and to projected changes in local climate. The three subprojects are sensitive to climate change due to their high sensitivities to present climate/weather extremes, and in the case of Hue, storm surge from the neighbouring Viet Nam sea. As a result, the large majority of subproject components have been designed to be resilient to climate change. Climate proofing ranges from elevated embankments, erosion resistant embankment materials and grades, drainage networks with increased and strengthened capacity for conveying runoff, and dredged lakes and rivers to improve flow and standing capacity.

505. The description of the feasibility designs of the three subprojects combined with available information on the affected environments are sufficient to identify the scope of potential environmental impacts of the Project. Providing that significant changes do not occur to the design of one or more subproject components, and that new sensitive environmental or social receptor data are not discovered, the subprojects will remain Category B for environment and will not require further detailed environmental impact assessment (EIA).

506. The anticipated adverse impacts during construction will be temporary, short-term, and likely to occur during the peak construction period. The IEE identified the lakes, rivers and canals that will be dredged and/or whose banks will be stabilized, homes and heritage sites of the Hue Complex of Monument adjacent to or in proximity to project facilities as the most sensitive sites. No sub-component will encroach on legally protected sites (protected forest, critical habitats, and cultural sites listed in the Complex of Hue Monuments). Impacts are anticipated to be confined within the components' immediate areas of influence, dredged material and waste disposal sites. Construction phase impacts will likely include dust, air emissions and noise; temporary deterioration of surface water quality and livelihood impacts on few informal fishermen during dredging and river embankment rehabilitation works; and temporary traffic disturbance with impacts on community safety. The impacts are unlikely to significantly affect ecological, social and physical cultural resources if the mitigation measures identified in the EMPs are implemented and monitored.

507. The project is not anticipated to generate significant adverse environmental impacts during operation. Cumulative greenhouse gas emissions generated from traffic on the subproject's roads are not expected to exceed ADB's threshold of 100,000 tons per year. The proposed wastewater treatment plant in Vinh Yen will reduce total pollution load to the Dam Vac Lake. The discharge of treated effluent is a new point-source of pollution, but is not expected to significantly affect overall lake water quality. Regular monitoring of WWTP effluent and lake water quality within the mixing zone will be conducted.

508. Mitigation measures for identified impacts are included in the environment management plans (EMPs). The EMPs define mitigation measures; supervision, monitoring and reporting requirements; public consultation and grievance redress procedures; and institutional

strengthening and EMP training requirements. The EMPs include an environmental monitoring program. The monitoring results will be used to evaluate (i) the extent and severity of actual environmental impacts against the predicted impacts, (ii) the performance of the environmental protection measures and compliance with relevant Vietnamese laws and regulations as well as internationally accepted standards as defined in the IFC Environment, Health and Safety Guidelines, (iii) trends of impacts, and (iv) overall effectiveness of the EMPs. The finalized EMPs based on the detailed engineering design and cleared by ADB will form part of the bidding documents. Adherence to the EMPs will reduce residual impact significance to acceptable levels. VODA, the HDPI, the HCPC, through their PMUs, are responsible for overseeing the implementation of the EMPs. Their capacities were reviewed and strengthening measures were included in the project design.

509. Meaningful public consultation was conducted in the framework of the PPTA and this IEE. Stakeholders were identified and engaged in a participatory manner. Stakeholder consultations focused on interviews and initial consultations with resource management agencies. The consultation process confirmed the city residents' broad support to the project. Concerns expressed, mainly related to construction impacts, were addressed in the EMPs. Possible complaints related to environment will be addressed through project-level Grievance Redress Mechanism at city level, to be coordinated by the PMUs.