PEOPLE'S COMMITTEE OF QUANG BINH PROVINCE

COASTAL CITIES SUSTAINABLE ENVIRONMENT PROJECT (CCSEP)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

(Final Report)

DONG HOI CITY SUB-PROJECT

November 2016

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ABBREVIATIONS

AH	Affected HHs
CC	Climate Change
BTN	Asphalt Concrete
RC	Reinforced Concrete
CMC	Construction Monitoring Consultant
CMD	Cubic Meter Per Day
CCSEP	Coastal Cities Sustainable Environment Project – Dong Hoi city sub-project
DED	Detailed Engineering Design
DOC	Department of Construction
DOF	Department of Finance
DONRE	Department of Natural Resources and Environment
DOT	Department of Transport
DPI	Department of Planning and Investment
EIA	Environmental Impact Assessment
ECOP	Environmental Code of Practice
EMC	Environmental Monitoring Consultant
EMP	Environmental Monitoring Plan
EMS	Environmental Monitoring System
FS	Feasibility Study
ODA	Official Development Assistance
PMU	Project Management Unit
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
TDC	Resettlement
TP	City
PPC	Provincial People's Committee (at provincial/ city level)
URENCO	Urban Environment Company
WB	The World Bank

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INTRODUCTION

1. PROJECT ORIGIN

The Coastal Cities Environmental Sanitation Project (CCESP) was implemented from 2007 to 2014 in three coastal cities, including Dong Hoi (Quang Binh province), Quy Nhon (Binh Dinh province), and Nha Trang (Khanh Hoa province). The Dong Hoi sub-project helped to reduce flooding problem significantly in the city center and improve the city's capacity to collect, transport and treat solid wastes and wastewater. Particularly, upon completion of the sub-project, the number of locations in the city subjected to frequent flooding have been reduced significantly, the numbers of households (HH) having access to solid waste collection service have increased from 13,626 (in 2007) to 26,000 (in 2014). In addition, the project has contributed to improve Dong Hoi city urban landscape and promote sustainable socio-economic development.

To ensure optimal efficiency of the CCESP, the Government of Vietnam has requested the World Bank to finance a new project named "Coastal Cities Sustainable Environment Project" (CCSEP), covering four cities, including Dong Hoi, Quy Nhon, Nha Trang, and Phan Rang – Thap Cham. The project will be implemented from 2017 to 2021 with an estimated cost of US$ 236 million. The estimated costs of Dong Hoi subproject is 58.11 millions USD. Dong Hoi city sub-project includes four components:

- Component 1 – Sanitation infrastructure: This component consists of drainage, wastewater collection and treatment, dredging and embankment lining the section left over from the CCESP in the Cau Rao river; enhancing solid waste collection capacity; installation of public toilets and construction of school toilets.
- Component 2 – Environment Infrastructure: 1.44 km new road will be constructed. Drainage, sewers, lighting, footpaths etc. are included.
- Component 3 – Land acquisition and site clearance: This component will provide compensation for the HHs affected under components 1 and 2.
- Component 4 – Technical assistance and utilities reform.

2. LEGAL AND TECHNICAL BASIS FOR THE ESIA

The project will comply with Vietnamese laws and regulations on environmental management. The project will also comply with the safeguard policies of the World Bank.

2.1. Vietnamese Legal Basis

❖ ***Legal documents***

- Law No. 55/2014/QH13 on Environmental Protection ratified by the National Assembly on 23/6/2014 and being effective on 01/01/2015;

  Administrative framework on Environmental Assessment

  The Law on Environmental Protection (No.55/2014/QH13) dated June 23, 2014 and Decree No. 18/2015/ND-CP on Environmental Protection Planning, Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Plans dated February 14, 2015 are key legal frameworks for environmental management in Vietnam. The Law on Environmental Protection (LEP) provides statutory provisions on environmental protection activities; measures and resources used for the purpose of environmental protection; rights, powers, duties and obligations of regulatory bodies, agencies, organizations, households and individuals who are tasked with the environmental protection task. LEP is applicable to regulatory bodies, public agencies, organizations, family households and individuals within the territory of the Socialist

Republic of Vietnam, including mainland, islands, territorial waters and airspace. LEP is on regulating strategic environmental assessment, environmental impact assessment and environmental protection commitment.

Furthermore, the law also indicated to consultation on, inspection and approval of the planning for environmental protection (Article 11, chapter II) as well as the list of entities subject to strategic environmental assessment in appendix I and II of the Decree No. 18/2015/ND-CP dated February 14, 2015 of the Government.

Article 13 of the Decree No. 18/2015/ND-CP explains the requirement of the pertaining ESIA agencies. Clause 1: the project owner or the advisory organization conducting ESIA must meet all requirements – (a) there are staff members in charge of ESIA meeting requirements prescribed in Clause 2 of this Article; (b) there is specialist staff members related to the project obtaining at least Bachelor‘s degrees; and (c) there are laboratories, inspection and calibration devices eligible for performing measurement, sampling, processing and analysis of environmental samples serving the ESIA of the project; if there is not any laboratory with decent equipment for inspection and calibration, it is required to have a contract with a unit capable of carrying out inspection and calibration. Clause 2: the staff members in charge of ESIA must obtain at least Bachelor‘s degrees and Certificate in ESIA consultancy and Clause 3: the Ministry of Natural Resources and Environment shall manage the training and issuance of Certificates in consultancy of ESIA.

The project does not involve wetlands and natural protected areas, neither does it relate to emission of persistent organic pollutants or international trade in endangered species of wild fauna and flora. Therefore, no relevant international environmental agreements to which Vietnam is a party would apply.

- Law No. 84/2015/QH13 on Occupational Safety and Health ratified by the National Assembly on 25/6/2015 and being effective on 01/072016;
- Law No. 17/2012/QH13 on Water Resources ratified by the National Assembly on 21/6/2012;
- Land Law No. 45/2013/QH13 approved by the National Assembly on 29/11/2013, being effective on 01/07/2014;
- Law No. 27/2001/QH10 dated 29/06/2001 on fire prevention and fighting by the National Assembly;
- Law No. 40/2013/QH13 dated 22/11/2013 revising and supplementing several articles of the Law on fire prevention and fighting;
- Construction Law No. 50/2014/QH13 dated 18/06/2014 and being effective on 01/01/2015;
- Labour Law on 10/2012/QH 13 dated 18/6/2012;
- Law No. 28/2001/QH10 on Cultural Heritage dated 19/6/2001;
- Decree No. 18/2015/ND-CP dated 14/02/2015 by the Government prescribing environmental protection master plan, strategic environmental assessment, environmental impact assessment and environmental protection plan; in accordance with Annex III of this Decree, an environmental impact assessment report (EIA) must be prepared for Dong Hoi city sub-project at the feasibility study phase. The EIA report will be submitted to Quang Binh provincial People’s Committee for appraisal and approval.
- Decree No. 19/2015/ND-CP dated 14/02/2015 by the Government detailing a number of articles of the Law on Environmental Protection;
- Decree No. 25/2013/ND-CP dated 29/3/2013 by the Government on environmental protection charges for wastewater;

- Decree No. 174/2007/ND-CP dated 29/11/2007 on environmental protection charges for solid wastes;
- Decree No. 88/2007/ND-CP dated 28/5/2007 by the Government on urban and industrial-park drainage;
- Decree No. 179/2013/ND-CP dated 14/11/2013 by the Government on sanction of administrative violations in the domain of environmental protection;
- Decree No. 43/2014/ND-CP dated 15/5/2014 by the Government detailing a number of articles of the Land Law;
- Decree No. 140/2006/ND-CP by the Government dated 22/11/2006 Providing for the environmental protection at phases of elaboration, evaluation, approval and implementation of development strategies, planning, plans, programs and projects.
- Decree No. 59/2007/ND-CP dated 09/4/2007 by the Government on solid waste management;
- Decree No. 38/2015/ND-CP dated 24/04/2015 by the Government on management of waste and discarded materials;
- Decree No. 80/2014/ND-CP dated 06/08/2014 by the Government on the drainage and treatment of wastewater and being effective on 01/01/2015;
- Decree No. 59/2015/ND-CP dated 18/6/2015 by the Government on construction project management;
- Decree No. 83/2009/ND-CP dated 15/10/2009 by the Government amending and supplementing some articles of Decree No. 12/2009/ND-CP by the Government on construction project management;
- Circular No. 27/2015/TT-BTNMT dated 29/05/2015 by the MONRE on strategic environmental assessment, environmental impact assessment, and environmental protection plans;
- Circular No. 22/2010/TT-BXD dated 03/12/2010 by the Ministry of Construction (MOC) on labour safety in works construction;
- Circular No. 09/2009/TT-BXD dated 21 May 2009 by the MOC detailing implementation of several articles of Decree No. 88/2007/ND-CP dated 28/5/2007 by the Government on urban and industrial park drainage;
- Circular No. 19/2011/TT-BYT dated 06/06/2011 by the Ministry of Health (MOH) guiding the management of labor hygiene, laborers' health and occupational diseases;
- Circular No. 16/2009/TT-BTNMT and Circular No. 25/2009/BTNMT by the MONRE on Vietnam national standards;
- Circular No. 32/2013/TT-BTNMT dated 25/10/2013 by the MONRE on national technical regulations on environment;
- Circular No. 10/2007/TT-BTNMT dated 22/10/2007 regulating quality assurance and quality control in environmental monitoring;
- Decision No. 02/2009/TT-BTNMT dated 19/03/2009 by the MONRE on assessment of sewage receiving capacity of water sources;
- Decision No. 16/2008/QD-BTNMT dated December 31, 2008 by the MONRE on national technical regulations on surface water quality,
- Decision No. 22/2006/QD-BTNMT dated 18/12/2006 by the MONRE on compulsory application of Vietnam environmental standards;
- Decision No. 505 BYT/QD dated 13/4/1992 by the MOH on sanitation standards.

❖ ***Applicable Vietnam Standards and Regulations***

Following Vietnam Standards (QCVN) are applied during preparation of the EIA:

Water quality:

- QCVN 03-MT:2015/BTNMT – National technical regulation on allowable limits of heavy metals in soils.
- QCVN 08-MT:2015/BTNMT - National technical regulation on surface water quality.
- QCVN 09-MT:2008/BTNMT - National technical regulation on groundwater quality.
- QCVN 14:2008/BTNMT - National technical regulation quality of domestic wastewater.
- QCVN 40:2011/BTNMT - National technical regulation on industrial wastewater.
- QCVN 25:2009/BTNMT - Wastewater of landfills: regulating maximum allowable concentration of pollution factors in wastewater of solid waste landfills when being discharged into receiving sources.
- TCVN 5502:2003 – Requirements of water quality – Water supply.
- TCVN 6773:2000 – Water quality – Water quality guidelines for irrigation purposes.
- TCVN 6774:2000 – Water quality - Fresh-water quality guidelines for protection of aquatic life.
- TCVN 7222:2002 – Water quality - General environmental requirements for central domestic (municipal) wastewater treatment plants.

Air quality:

- QCVN 05:2013/BTNMT- Air quality - National technical regulation on ambient air quality.
- QCVN 06:2009/BTNMT – Air quality – Maximum allowable concentration of harmful substances in ambient air.
- TCVN 6438:2001 – Road vehicles - maximum allowable limit of emission.

Solid waste management:

- Decision No. 27/2004/QD-BXD dated 09/11/2004 by the MOC on issuance of TCXDVN 320: 2004 - "Landfills for hazardous wastes – Design standards".
- TCVN 6696:2009 – Solid wastes – Sanitary landfills. General requirements on environmental protection.
- QCVN 07:2009/BTNMT - Hazardous waste thresholds.
- QCVN 25:2009/BTNMT- National technical standards on wastewater of solid waste landfills.

Quality of land and sediments:

- QCVN 03-MT:2015/BTNMT – National technical standards on allowable limits of heavy metals in the soils.
- QCVN 15:2008/BTNMT – Land quality – National technical standards on pesticide residues in soils.
- QCVN 43:2012/BTNMT – National technical standards on sediment quality in fresh water areas.

Noise and vibration:

- QCVN 26:2010/BTNMT- National technical standards on noises.
- TCVN 5948:1999 - Acoustic - Noise emitted by accelerating road vehicles - Permitted maximum noise level.
- QCVN 27:2010/BTNMT- National technical standards on vibration.

Water supply and drainage:

- TCVN 7957:2008 - Drainage and Sewerage – External networks and facilities – Design standard.
- TCXDVN 33:2006 – Water supply – Pipeline networks and facilities – design standard.

Occupational health and safety:

- Decision No. 3733/2002/QD-BYT dated 10/10/2002 on application of 21 standards on health and safety.

2.2. Safeguard Policies of the World Bank

The Project shall comply with social and environmental safeguard policies of the World Bank. Applicable policies for this project are:

- Environmental Assessment (OP 4.01)
- Physical Cultural Resources (OP. 4.11);
- Involuntary Resettlement (OP 4.12)
- Public consultation and information disclosure

This social and environmental impact assessment also follows IFC's guidelines on Environment, Health, and Safety Guidelines - "EHS Guidelines" of the World Bank: <http://www.ifc.org/wps/wcm/ connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2B Guidelines.pdf?MOD=AJPERES>.

2.3. Social Policy Framework

- Land Law No. 45/2013/QH13 with effectiveness on 1/7/2014;
- Decree No. 43/2014/ND-CP by the Government detailing implementation of the Land Law No. 45/2013/QH13;
- Decree No. 44/2014/ND-CP by the Government on land prices;
- Decree No. 47/2014/ND-CP by the Government regulating resettlement, compensation, and allowances upon land acquisition by the State;
- Decree No. 84/2013/ND-CP by the Government on resettlement and housing development management;
- Decree No. 38/2013/ND-CP dated 23/4/2013 by the Government on management and use of official development assistance (ODA) and concessional loans of donors;
- Decision No. 582/QD-TTg dated 06/4/2016 by the Prime Minister on approval of investment scope of the Coastal Cities Sustainable Environment Project – Dong Hoi city sub-project, Quang Binh province.
- Circular No. 36/2014/TT-BTNMT dated 30/6/2014 detailing compensation and allowances upon land acquisition by the State.
- Decision No. 1538/QD-UBND dated 06/7/2012 by Quang Binh PPC on approval of the revised master planning for Dong Hoi city and its surroundings to 2025, with vision to 2035.
- Decision No. 479/QD-UBND dated 25/02/2016 by Quang Binh PPC assigning preparation of the Coastal Cities Sustainable Environment Project – Dong Hoi city sub-project, Quang Binh province to the Environment, Urban Infrastructure, and Climate Change Adaptation Projects Preparation Unit of Dong Hoi city, Quang Binh.
- Decision No. 22/2014/QD-UBND dated 09/09/2014 by Quang Binh PPC on resettlement, compensation, and allowances upon land acquisition by the State in Quang Binh province.
- Decision No. 11/2015/QD-UBND dated 26/3/2015 by Quang Binh PPC regulating adjustment factors for land prices in Quang Binh province in 2015;
- Decision No. 36/2015/QD-UBND dated 22/12/2014 by Quang Binh PPC regulating prices of various land types and categorization of urban areas, communes, areas, and land locations in Quang Binh province in the period 2015 – 2019;
- Decision No. 37/2014/QD-UBND dated 31/12/2014 by Quang Binh PPC on issuance of price framework for land-attached houses and facilities for compensation upon land acquisition by the State in Quang Binh province;

- Decision No. 08/2015/QD-UBND dated 10/2/2015 by Quang Binh PPC on issuance of price framework for trees, and allowances for aquaculture, graves, and relocation upon land acquisition by the State in Quang Binh province.

2.4. Documents and Reports Prepared by the Project Employer

- Feasibility Study Report;
- Environmental Impact Assessment Report for the Coastal Cities Sustainable Environment Project – Dong Hoi city sub-project, approved by Quang Binh PPC;
- Social Assessment Report for the sub-project;
- Resettlement Action Plan;
- Environmental Assessment of relating projects;
- Technical drawings relating to the project works;

3. ARRANGEMENTS FOR ENVIRONMENTAL IMPACT ASSESSMENT

The Employer of the subproject is the Environment, Urban Infrastructure, and Climate Change Adaptation Projects Preparation Unit of Dong Hoi city, Quang Binh. The Employer has signed a contract with the Joint Venture between the Natural Resources and Environment Investment and Development Joint Stock Company and & the Institute of Agricultural Planning and Design to prepare the Social and Environmental Impact Assessment for Dong Hoi city sub-project.

The Employer:

- Name of the Employer: The Environment, Urban Infrastructure, and Climate Change Adaptation Projects Preparation Unit of Dong Hoi city
- Representative: Mr. Nguyen Van Thuan
- Position: Director
- Address: 34 Tran Quang Khai, Dong Hoi city, Quang Binh province
- Tel: 0523 509 689 Fax: 0523 840 734

The Consultant:

- Name of the Consultant: the Joint Venture between the Natural Resources and Environment Investment and Development JSC. and the Institute of Agricultural Planning and Design
- Representative party: Natural Resources and Environment Investment and Development JSC.
- Representative: Ms. Ngo Thi Binh
- Position: Director
- Address: 59 Chua Boc, Trung Liet ward, Dong Da district, Hanoi
- Tel: 0435 642 862 Fax: 0435 642 862

The list of ESIA preparation team are included in Table 1 below.

Table 1: ESIA preparation team

No.	Name	Qualification	Assigned tasks	Signature
The Consultant - Natural Resources and Environment Investment and Development JSC.				
1	Pham Trung Kien	Master of Water Resources Management	Team Leader	
2	Nguyen Quang Vinh	Master of Environment Sciences	Assess environmental impacts and recommend mitigation measures	
3	Phi Thi Hang	Master of Environmental	Evaluate existing environmental and socio-economic baselines of the	

No.	Name	Qualification	Assigned tasks	Signature
		Economics	project areas, and provide a brief summary of the project	
4	Nguyen Duy Khanh	Hydro-meteorology and Environment Engineer	Conduct surveys to collect information on natural and socio-economic baselines in the project areas	
5	Ngo Thi Binh	Irrigation Engineer	Analyze and assess construction methods proposed for the project works	
6	Nguyen Tien Luyen	Construction Engineer	Analyze and assess construction methods proposed for the project works	
7	Do Thi Thu Huyen	Master of Natural Resources and Environment Management	Prepare an environmental monitoring and management program	
8	Tran Thi Hong Gam	Master of Natural Resources and Environment Management	Prepare an environmental monitoring and management program	
The PMU				
1	Nguyen Van Thuan	Environment Engineer	Provide project and legal documents	
2	Truong Tan Lam	Construction Engineer	Provide documents relating to design drawings of the project works	
3	Nguyen Anh Tuan	Water Supply and Drainage Engineer	Provide data relating to drainage and sewerage systems in the project areas	
4	Nguyen Quang Hoa	Bachelor of Environment	Provide data relating to Duc Ninh Wastewater Treatment Plant (WWTP) Conduct site surveys and review the ESIA before submitted to the WB and Quang Binh PPC	

4. ESIA METHODOLOGY

The following methods were applied by the Consultant during preparation of the ESIA:

- ***Rapid Assessment Method:***

Rapid assessment method was issued by the World Health Organization (WHO) in 1993. Basis of this method is nature of materials, technologies, rules of natural processes as well as experiences in rating pollution loads. In Vietnam, this method is introduced and applied in various ESIA studies, performing relatively accurate calculation of pollution loads in the context of limited measurement and analysis instruments. In this report, factors of pollution loads follow the WB's guidelines *(Environmental Assessment Sourcebook, Volume II, Sectoral Guidelines, Environment, World Bank, Washington D.C 8/1991)* and *Handbook of Emission, Non Industrial and Industrial source, Netherlands.*

- ***Matrix:***

This method builds correlation between effects of each sub-project activity to each issue and environmental composition as shown in the impact matrix. This directs contents of detailed impact assessment.

- ***Environmental Modelling:***

This method is applied to calculate and simulate transmission processes, via mathematic equation, of exhaust emission and wastewater, etc. generated by the project in the environment.

- ***Comparison:***

The compassion method aims at assessing quality of the environment and effluents, and pollution loads, etc. by comprising data against relevant environmental standards, regulations stipulated by the MOH, and relevant researches and experiments.

- ***Impact Identification Method:***

This method is applied through following detailed steps:

+ Describe the environment system.
+ Identify the sub-project components that affect the environment.
+ Identify a full range of related effluents and environment issues for detailed assessment.

- ***Listing Method:***

This method is used commonly (since the establishment of National Environmental Protection Agencies - NEPA - in some countries) and provide many positive results thanks to various strengths such as clear and systematic approach throughout the whole process of analysis and assessment. It includes two main categories:

+ Descriptive checklist: This method gives a checklist of environmental research components and information on measurement, prediction, and assessment.
+ Simple checklist: This method gives a checklist of potentially affected environmental components.

- ***Systematic Analysis Method:***

This method is applied quite widely in environmental assessment. Its strength is providing comprehensive assessment of all impacts that is useful for identification of impacts and disposal and discharge sources.

The method is deployed in consideration of disposal and discharge sources, impact causes, impacted objects, and environmental compositions, etc. elements of a system which have close relationships; then impacts are identified, analyzed, and assessed.

- ***Public consultation:***

This method is used to interview leaders and local people at the project sites to collect necessary information for environmental assessment. Particularly, the project benefits and potential negative impacts on the environment and daily life are introduced. Throughout this process, comments, feedbacks, and desires of the local people towards the project are consolidated.

Besides, local staff and people are interviewed about socio-economic development at their localities.

- ***Literature review:***

This method aims at identification and evaluation of natural and socio-economic conditions of project sites via data and information collected from various sources, such as statistical yearbooks, socio-economic reports, environmental reports, and relevant research and studies.

In addition, inheritance of former research and studies is really essential to use up available findings and further identify limitations.

- ***Field Survey:***

Field survey is compulsory for environmental assessment to identify existing status of project sites and relevant objects in vicinities, determine sampling locations, and survey existing status of water supply, drainage and sewerage, and power supply, etc.

The Consultant conducted topographic and geological surveys to collect hydro-meteorological data for design purposes, in accordance with applicable Vietnam standards. The survey results are used to evaluate natural conditions of the project sites.

- ***Expert Method:***

This method takes advantage of expertise and experiences in environmental sciences of experts of the Consultant and other scientific research institutes.

- ***Sampling and Analyzing in Laboratory:***

Sampling and sample analysis for environmental components (soil, water, air) are indispensable to determine and evaluate status of baseline environmental quality at the project sites.

After site surveys, sampling and sample analysis programs will be developed with key contents as: sample locations, measurement and analysis parameters, workforce, required equipment and tools, implementation timelines, sample preservation plans, and analysis plans, etc.

For this project, the Consultant monitored, took, and analyzed samples of air, water, soil, sediments, and aquatic species at the project sites in accordance with applicable Vietnam standards.

+ *Air samples*:

Dust: Samples were taken and analyzed in accordance with TCVN 5067:1995, and sampling tool is TSP-2 Staplex.

SO_2: Samples were taken with equipment SIBATA MP - ∑300N in accordance with TCVN 5971: 1995. Samples were analyzed with color–based sample analysis method using spectrum equipment labelled UV -1691 PC…

CO: Samples were taken and analyzed in accordance with Standard HD.5.7-13.

+ *Samples of water, soil, and sediments*

Standard TCVN 6663-6:2008: Guidelines on taking samples of river and stream water. TCVN 5999:1995: Guidelines on taking wastewater samples. TCVN 6000:1995: Guidelines on taking groundwater samples. Standard TCVN 7176:2002 Methods of taking biological samples – Guidelines on taking samples of big spineless creatures with hand rackets. Standard TCVN 6663-15:2004: Guidelines on taking watery sludge and sediment samples. Standard TCVN 6663-3:2008: Guidelines on maintenance and treatment of samples.

Methods of parameter analysis are in accordance with Vietnam and ISO standards as below:

1- pH: Measured directly with digital meter Wagtech, in accordance with TCVN 6492:2011.

2-DO: Measured directly with digital meter Wagtech, TCVN 7325:2004.

3-Total suspended solids (TSS): gravimetric method, TCVN 6625:2000, analyzed at laboratory.

4-BOD_5: use BOD Track analysis tool set, in accordance with TCVN 6001-1:1995, analyzed at laboratory.

5-COD: use COD analysis instrument by HACH, including color detection DR/890, sample breaking instrument, in accordance with SMEWW 5220 D:2005, analyzed at laboratory.

6- NH_4^+-N: use spectrophotometer Shimazu UV - 1691 PC in accordance with TCVN 6179-1:1996, analyzed at laboratory.

7- NO_3^--N: use spectrophotometer Shimazu UV - 1691 PC in accordance with Hach Method 8507, analyzed at laboratory.

8-PO_4^3: use two-channel ion chromatography instrument LC-0ADVP, CDD detector or ultraviolet spectrum analysis instrument with Shimazu UV - 1691 PC in accordance with TCVN 6202:2008, analyzed at laboratory.

9-Cd, Zn, Fe, Pb, Cu, Cd…: Analyzed with SMEWW 3113B:2005, in accordance with SMEWW 3113B:2005, analyzed at laboratory.

10- Oil and petroleum jelly: gravimetric method, TCVN 5070:1995, analyzed in laboratory.

11- Coliform: Tube method, TCVN 6187-2:1996, analyzed in laboratory.

12- Chloride: use two-channel ion chromatography instrument LC-0ADVP, CDD detector in accordance with SMEWW 4500:Cl^-E, analyzed at laboratory.

5. RELATED PROJECTS AND PLANS

5.1. Related Projects

1. The Coastal Cities Environmental Sanitation Project (CCESP) – Dong Hoi city sub-project

The CCESP - Dong Hoi city sub-project –was implemented from 2007 to 2014. Dong Hoi city sub-project consisted of following investment items:

- Construction and installation of 16.2 km of a combined drainage system, 26.3 km of HDPE sewers and 24.1 km of tertiary drains;
- Construction of 1,063 manholes along the drainage lines, 2,892 manholes for household connection, and 593 odor-prevention manholes;
- Installation of 11 combined sewer overflows (CSO) and 14 pumping stations;
- Dredging of 2,925m and lining 3,611m embankment of the Cau Rao river, dredging 3,100 m of Phong Thuy canal;
- Construction of Duc Ninh WWTP using chain of biological treatment ponds. Designed capacity is 10,000 cmd by 2020 and 19,000 cmd by 2030; provision of a SCADA system for automatic management of the wastewater collection and treatment system.
- Improvement of Ly Trach landfill, provide equipment for solid waste collection and management, and drainage management;

Several items were proposed under the CCESP but not yet be implemented. These will be included in the CCSEP, including:

- Dredging and lining of 475 m of the Cau Rao river;

- Provision of 16 aerators for Duc Ninh WWTP;

- Supply additional equipment for solid waste collection to fulfil the original proposals of the CCESP.

2. Urban Environment and Climate Change Adaptation Project – funded by the ADB.

Project implementation period: From 2016 to 2020.

The project components relating directly to the CCSEP are as below:

Component 1: Climate change resilient urban (Bao Ninh component)

(i) Bao Ninh wastewater collection system: including 13.1 km of gravity sewers, 3.5 km of pumping mains and three (03) pumping stations.

Component 2: Improved wastewater management in Dong Hoi

(i) Household connections (8,238) and associated tertiary sewers (55.6 km);
(ii) One pumping station and one Combined Sewer Overflow (CSO);

These works of the Urban Environment and Climate Change Adaptation Project – Dong Hoi city Sub-project will help to collect 1,990 m^3 of wastewater each day in Bao Ninh peninsula then transmit to Duc Ninh WWTP for treatment, increasing the Plant capacity to 14,800 cmd.

Due dilligence reivew of the CCESP and the Urban Environment and Climate Change Adaptation Project is presented in Annex 6

3. Related Plans

- Revised master planning for Dong Hoi city and its surroundings to 2025, vision to 2035, approved by Quang Binh PPC via Decision No. 1538/QD-UBND dated 06/7/2012;

CHAPTER 1: BRIEF DESCRIPTION OF THE SUB-PROJECT

1.1 NAME OF THE SUB-PROJECT

COASTAL CITIES SUSTAINABLE ENVIRONMENT PROJECT (CCSEP) - DONG HOI CITY SUB-PROJECT

Herein after referred to as "The Project"

1.2 THE EMPLOYER

The sub-project Employer: Quang Binh PPC

The Sub-project Steering Committee (PSC): The former CCESP sub-project Steering Committee will continue acting as the PSC of this Sub-project. The PSC is chaired by the chairman of the PPC while vice chairman of the PPC acts as the standing vice chairman of the PSC. Members of the PSC are leaders of relevant provincial-level key departments such as the PPC Office, Department of Planning and Investment, Department of Construction, Department of Finance, Department of Natural Resources and Environment, Department of Transportation, Dong Hoi city People's Committee and relevant service companies.

Implementing Agency: Environment, Urban Infrastructure, and Climate Change Adaptation Projects Preparation Unit of Dong Hoi city

Address: 34 Tran Quang Khai, Dong Hoi city, Quang Binh province

Tel: 0523 509 689 Fax: 0523 840 734

Email: bqldavsmt@vnn.vn

Representative: Mr. Nguyen Van Thuan Position: Director

1.3 THE SUB-PROJECT LOCATION

The CCSEP – Dong Hoi city sub-project will be implemented in Dong Hoi city, Quang Binh province

1.4 SCOPE OF WORK

1.4.1. Objectives of the Sub-project

Objectives of the CCSEP – Dong Hoi city sub-project are set in the project detailed outline as below:

"Improve environmental conditions and health of the city population through expansion of drainage and wastewater collection systems, pumping stations, tertiary drains (R3), enhance household connections, reduced pollution of groundwater and surface water, hence, reduced environmental pollution. Strengthen solid waste collection capacity, improve toilets at schools, improve public toilets, improve household sanitation conditions, and improve health of the local people.

Complete the technical infrastructure, improve urban landscapes and living conditions to facilitate tourism development as a key economic sector of the province, contribute to make the city meet class II city criteria, and class I city in the future."

1.4.2. Scope of Work

The sub-project comprises of four components:

Component 1 – Sanitation infrastructure;

Component 2 – Environment Infrastructure;

Component 3 – Land acquisition and site clearance;

Component 4 – Technical assistance and utilities reform.

Proposed investments of Dong Hoi city sub-project is listed in below Table 1.1.

Table 1.1: List of Proposed Investments

Component	Description	Main technical specification
Component 1: Sanitation infrastructure	Install, build drainage and sewers combined	9.82 km D600-1500 reinforced concrete (RC) drains or box culverts B x H =3000 x 1500.
	Build stormwater outfalls	Six (06) D1500 RC stormwater outfalls
	Install sewers	14.07 km D150 – 500 HDPE pipes at 1m – 4m deep
	Install R3 tertiary drains	41.1 km D300 uPVC pipes, at 1-2 m deep
	Build wastewater pumping stations (PS)	Build five (05) PSs, reinforced concrete structures, dimension 2.5 x 2.5 m to 4 x 4m, pump chambers are at 6.5 - 8m deep
	Dredge and embankment lining of the Cau Rao river	475 m
	Rebuild Cong Muoi bridge	- Demolish the existing Cong Muoi bridge and build a new one at the same location - L = 48.50m; B = 17m - Three spans, 01 arch span and 02 beam spans
	Provide supplement equipment for the WWTP	Supply and install 16 aerators using wind/solar energy
	Provide supplement equipment for solid waste collection and treatment	- Five (05) compactor trucks - 500 waste bins with capacity 240 – 500 liters; - 500 hand carts; - One (01) tank truck
	Install public mobile toilets and build school toilets	- 11 school toilets and six (06) mobile public toilets.
Component 2: Environment Infrastructure	Road construction	1.44km road, B = 36m wide including 2x6m pavement. Drains, sewers, technical box, lighting system, trees included
	Bridge construction	Two (02) new bridges on the are constructed along the 1.44 km road alignment: - Le Ky bridge: 212m long, including six (06) 33m-long spans, 30m wide; - Tay bridge: 24 m long with one (01) span, 21 m wide.
Component 3	Land acquisition and site clearance	- Compensate for HHs affected by the project
Component 4	Technical support and utilities reform	- Support project monitoring and implementation and operation

The project will be implemented in 11 wards and communes in Dong Hoi city of which the locations are shown in Figure 1.1.

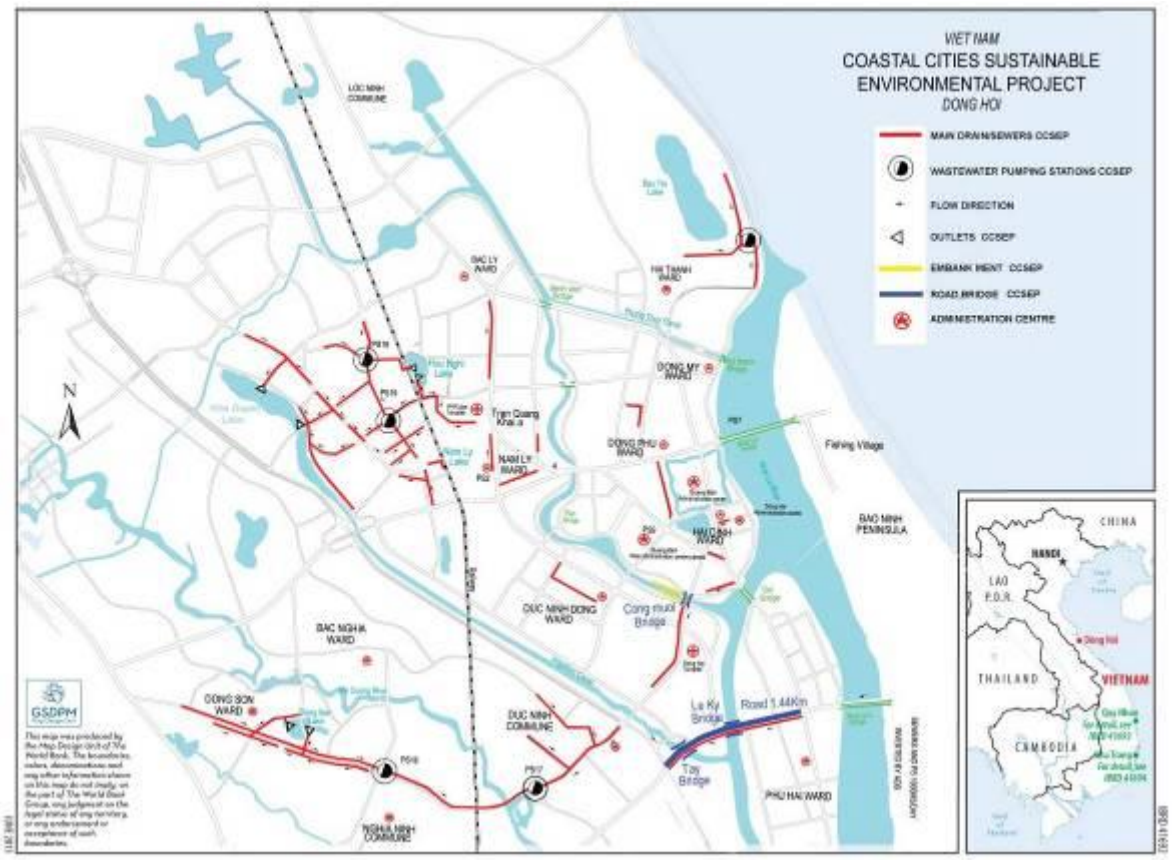


Figure 1.1: Overall Map of the CCSEP

1.4.2.1 Component 1: Sanitation Infrastructure

The locations of the proposed works under Component 1 are shown in Figure 1.2 below.

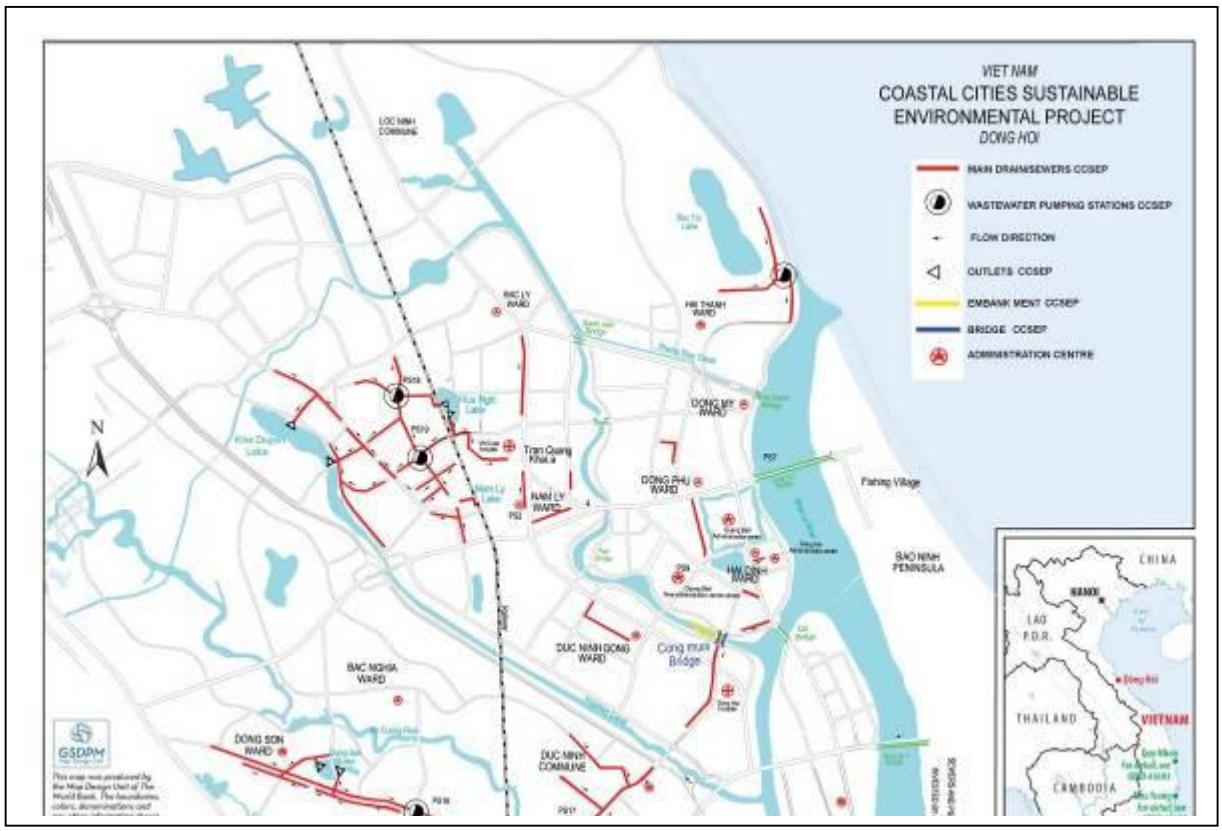


Figure 1.2: Locations of Proposed Investments under Component 1

This component includes following investments:

(i) Construction and installation of 9.82 km of combined RC drains D600-1500 or box culverts BxH=3000x1500 at Dong Son, Bac Ly, Nam Ly, and Phu Hai wards. The alignment follows existing roads.

(ii) Construction of six RC outfalls, D1500, all outfalls will be connected to existing drains installed under the CCSEP project to discharge stormwater into balancing lakes. Locations of the outfalls are presented in Table 1.2.

Table 1.2: Outfall Locations

Name	Location/ Coordinates	Connection alignment	Receiving lake	Basin area (ha)
CX 1	X: 1929873.71 (m) Y: 562001.78 (m)	Drainage route No. 1	Dong Son lake	32.7
CX 2	X: 1929738.72 (m) Y: 562160.71 (m)	Drainage route No. 3		
CX 3	X: 1933231.08 (m) Y: 563094.53 (m)	Drainage route No. 24	Tay Huu Nghi lake	180.25
CX 5	X: 1932625.32 (m) Y: 562163.75 (m)	Drainage route No. 6		
CX 4	X: 1933083.87 (m) Y: 563250.79 (m)	Drainage route No. 16	Khe Duyen lake	64.65
CX 6	X: 1933034.02 (m) Y: 561784.53 (m)	Drainage route No. 22		

(iii) Construction and installation of 14.07 km of D150-500 HDPE pipes in roadways with the installation depth of 1- 4.5 m.

Table 1.3: Quantity of Combined Drains and Sewers

No.	Road	Pipe size	Route	Length (m)	Installation depth (m)
1	Ly Thai To	D1000-L=490m D1000-L=305m D600: L=149m D800: L=123m D1000-L=333m D1000-L=498m D1500-L=249m D300-L=505m D200- L=1191m D300-L=522m D400-L=215m D200- L=780m D400- L=456m	Drainage route Nos. 1, 3, 3A, 4, 5 Sewer route Nos. 1, 2, 3, 5, 6	5,816	1.2 – 4.3
2	Le Hong Phong	D1500-L=275m D600- L=97m D400-L=1898m	Drainage routes Nos.1, 2 Sewer route No. 1	2,270	1.8 – 2.2
3	Phan Huy Ich	D300=L=520m D300-L=558m D300-L219m	Sewer routes Nos. 4, 16	1,297	1.6 – 2.5
4	Tran Nhat Duat	D300 -L=628m	Sewer route No. 7	628	1.2
5	Nguyen Van Troi	D300- L=400m	Sewer route No. 8	400	1.08 - 3.09
6	Ngo Gia Tu	D800- L=88m D300-L=495m	Drainage route No. 7 Sewer route No. 9	583	1.67 - 3.35
7	Huu Nghi	D800-L=132m D1000-L=562m	Drainage routes Nos. 8, 14	694	1.3 - 1.5
8	To Huu	D800-397m	Drainage route No. 9	397	1.3
9	Nguyen Van Linh	2mX2m-L=188m	Drainage route No. 10	188	2.5
10	Le Truc	D800-L=132m	Drainage route No. 11	132	1.3

No.	Road	Pipe size	Route	Length (m)	Installation depth (m)
11	Nguyen Huu Canh	D800-L=160m	Drainage route No. 12	160	1.3
12	Sub-zone 4, Dong Phu	D1500-L=268m	Drainage route No. 13	268	2
13	Alley in Thong Nhat road (Duc Ninh Dong)	D600-L=226m	Drainage route No. 15	226	1.5
14	Phan Dinh Phung	D1000-L=403m D1500-L=342m D1000-L=258m D1500-L=333m D1000-L=244m D800-L=134m D1000-L=403m D1500-L=342m	Drainage routes Nos. 16, 17, 18, 22, 24	2,459	1.3 - 2
15	Hoang Dieu	D800-L=299m D1000-L=77m D800: L=288m	Drainage routes Nos. 19, 20	664	1.3 - 2
16	Le Loi	D600: L=167m D800: L=99m D600-L=173m D600- L=136m D800-L=217m	Drainage routes Nos. 21, 25	792	1.2 - 1.5
17	Ton That Tung	D600- L= 120m D800- L=125 m D300- L=272m D300-L=208m	Drainage route No. 6 Sewer routes Nos. 10, 22	725	2.15 - 2.47
18	Trung Truong	D1000- L=147 m D15000- L=157 m	Drainage route No. 6	304	1.5 - 2
19	Bau Tro fence	D300- L=316m D300- L=733m	Sewer routes Nos. 11, 28	1,049	1.6 - 2.4
20	Truong Phap	D150- L=499m	Sewer route No. 12	499	1.2
21	Hoang Sam	D300-L=191m D400-L=229m D300-L=405m D150- L=432m D200- L=346m	Sewer routes Nos. 13,15, 23, 24	1,603	1.2 - 3.46
22	Sub-zone 9, Bac Ly	D1000-L=453m D1500-L=436m D300 -L=475m	Drainage route No. 24 Sewer route No. 14	1,364	1. 45 - 3m
23	To the Culture House of Sub-zone 10	D300- L=195m	Sewer route No. 17	195	2 - 2. 3
24	To TB 19	D300-L=440m D300-L=200m	Sewer routes Nos. 19, 21	640	1.5 - 3.74
25	Vu Trong Phung	D300-L=334m	Sewer route No. 20	334	1.8 - 2. 4
26	Le Duc Tri	D300-L=1047 D300-L=198m D300- L=420m	Sewer routes 25, 26, 27	1,665	1.5 - 2.6

Source: Feasibility Study – August 2016

(iv) Installation of 41.1 km of D300 uPVC tertiary sewers R3 at depth of 1-2m, construction of 3,616 brick manholes size 800x800mm at every 12 - 20m intervals for household connections. A layout of secondary and tertiary drains (household connections) is presented in following figure.

Figure 1.3: Model of Secondary and Tertiary Drains

(v) Construction of 05 reinforced concrete pumping stations, dimensions from 2.5x2.5m to 4x4m with the depth from 6 to 8m.

Table 1.4: Quantity and Proposed Locations of Wastewater Pumping Stations

NNo.	WPS	Location	Coordinates	Capacity (cmd)	Area (m2)/(depth)	
					Construction	Finished works
1	PS15	Truong Phap road – Hai Thanh ward	X=566 427.920 (m) Y= 1 934 322.420 (m)	950	26.24	16.74
					6.5	6
2	PS16	The road connecting Nhat Le bridge with the Bypass	X: 566 361.950 (m) Y: 1 929 847.150 (m)	1,078	26.24	16.74
					5	4.5
3	PS17	Le Loi road – Duc Ninh commune	X:566 330.720 (m) Y: 1 929 231.210 (m)	1,360	37.74	26.24
					6	5.5
4	PS18	Ly Thai To road – Dong Son	X: 562 725.900 (m) Y: 1 929 475.530 (m)	1,080	26.24	16.74
					5	4.5
5	PS19	Hoang Sam road - Bac Ly ward	X: 562 838.710 (m) Y: 1 932 844.240 (m)	980	37.74	26.24
					5.7	5.2

Source: Feasibility Report - May 2016

(vi) Dredging and embankment lining of 475 m of Cau Rao river: the average width of the river at this section is about 50m. The river bed will be dredged to the design level from -1.2 to -1.7m. River embankment will be shaped and lined. Top part of the embankment shall be reserved for grass planting (total 1,439 m^2). 184 willow trees will be planted along the riverside road (This item was proposed but not implemented under CCESP_.

(vii) Construction of Cong Muoi bridge: demolish the existing Cong Muoi bridge and build a new bridge L = 48.5m and B = 17m with three spans and one 30.39m-long arch span and two 8m-long beam-slab spans.

Figure 1.4: Dredging of Cau Rao River Downstream and Cong Muoi Bridge

(viii) Supply of equipment for Duc Ninh WWTP:

16 aerators using wind/solar energy will be provided for the Duc Ninh WWTP (constructed under CCESP). The WWTP's design capacity is 10,000 cmd by 2020 and 19,000 cmd by 2030. The 16 aerators were included in the original design of the WWTP but not purchased under the CCESP due to lack of financial resources.

The Duc Ninh WWTP has a chain of biological ponds for wastewater treatment.

The mixing water volume of the aerators is 2500m^3/h. The aerators will provide continuously moving flows (9m^3 /second) that in turn increase concentration of dissolved oxygen to boost activation of micro-organism in water and enhance wastewater treatment efficiency.

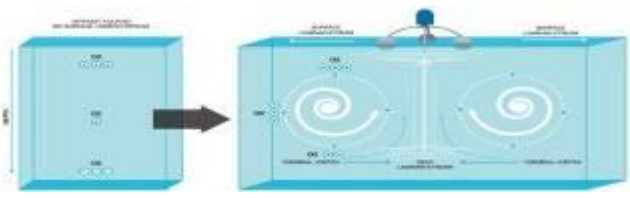


Figure 1.5: Model of Aerators

(ix) Supply of solid waste collection equipment, including five (05) compactor trucks, 500 waste bins of capacity from 240 to 500 liters, 500 hand carts and one (01) tank truck.

Figure 1.6: Waste bins

(x) Construction of 11 school toilets and installation of six mobile public toilets at locations indicated in Table 1.5:

Table 1.5: List of School and Public Toilets

No.	Location	No. of pupils served (to 2020)
I	**School toilets**	
1	Dong Son No. 1 secondary school	560
2	Duc Ninh primary school	617
3	Bac Nghia secondary school	625
4	Duc Ninh Dong secondary school	615
5	Duc Ninh secondary school	615
6	Hai Thanh secondary school	522
7	Loc Ninh secondary school	615
8	Quang Phu secondary school	362
9	Bac Ly No. 2 secondary school	625
10	Nam Ly No. 2 secondary school	600
11	Nam Ly No. 1 secondary school	600
II	**Public mobile toilets**	**Type**
1	Khe Chuoi, Quang Phu beach	mobile
2	Con market	mobile
3	Embankment of the Nhat Le river (Hai Thanh bridge)	mobile
4	Tam Toa park (opposite to Han Mac Tu road)	mobile
5	Coconut Garden, opposite to Quang Binh lottery company	mobile
6	Cong Doan market	mobile

Proposed mobile public toilets: semi-automatic, external dimensions: 1.8m x 4.2m x 2.4m (depth x width x height), internal dimensions of each module: 1.5m x 1.4m x 2.2m (depth x width x height), administration compartment: 1.8m x 1.0m x 2.4m) (depth x width x height), single modules, easy for installation or relocation.

Figure 1.7: Photos of Mobile Public Toilets

1.4.2.2 Component 2: Environment Infrastructure

The locations of proposed investments under Component 2 are shown in Figure 1.8.

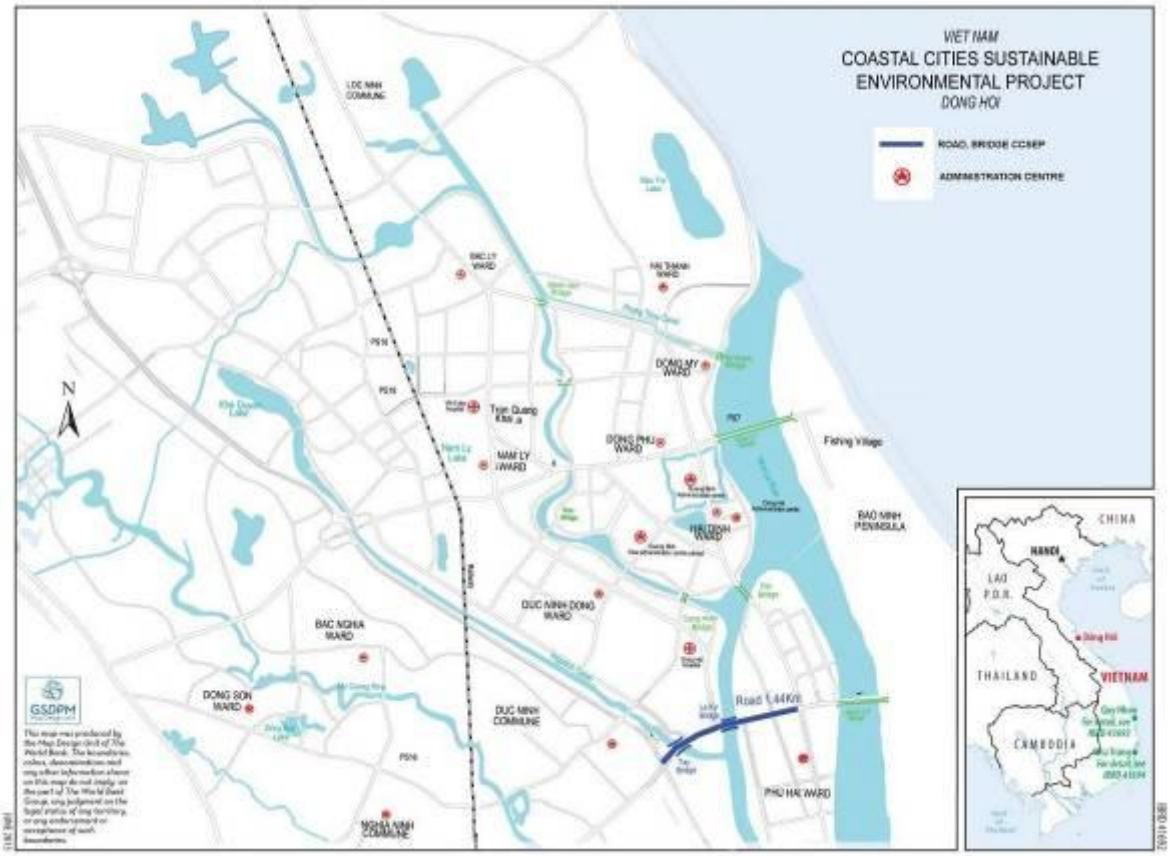


Figure 1.8: Locations of Proposed Investments under Component 2

Construction of 1.44 km of the road from Nhat Le II to the city bypass, Bn = 36m including 21 m road surface, 2x6m and the sidewalk and 3m wide road divider. Designed velocity is Vtk=60Km/h. Drainage, lighting systems, and trees are included.
There are two bridges on the alignment, namely Le Ky and Tay bridges.
An outline of the route is presented in Figure 1.9 as below:

Figure 1.9: Route Outline

Le Ky bridge

The bridge is 211.85m long, 30 m wide, has six 33m-long prestressed reinforced concrete beams, 12 lam post using high-pressure mercury lamps. The bridge is made of C12.5 reinforced concrete, 70mm thick.

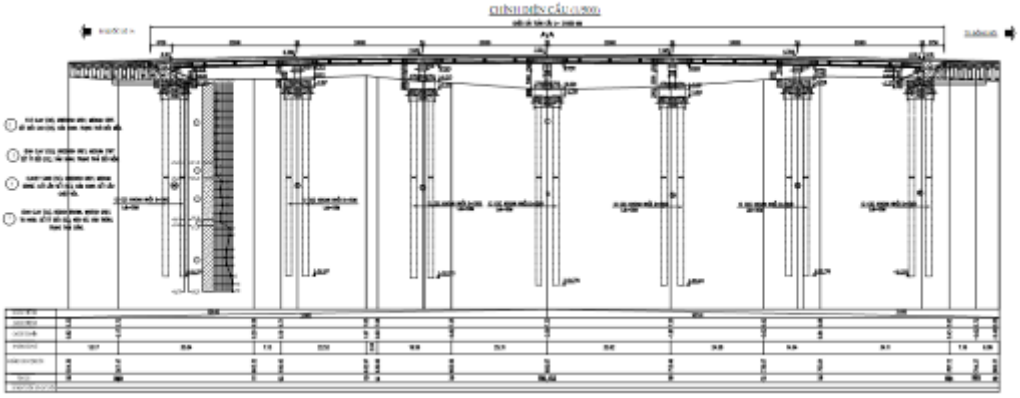


Figure 1.10: Longitudinal Cross of Le Ky bridge

Tay bridge includes one T-shaped beam made of prestressed reinforced concrete, L_{beam}=24m.

- The bridge is surfaced with a layer of 70mm-thick C12.5 asphalt concrete, RC handrail built on-site. Handrail post, handrails, and cross rails are made of aluminum alloys. Bridge abutments are made of in-situ reinforced concrete, and the foundation is formed of bored piles D=1.0m.

1.4.3. Construction Methods

(i) Civil works for Component 1:

Construction of drains, sewers, manholes, and outfalls

Successive construction method will be applied for drains and sewers.

Use cutters to cut concrete/asphalt roads. Use excavators (bucket capacity 0.8m^3) to remove the materials in the trench. Use vibrating hammers or hydraulic press to install Larsen sheet piles to protect the walls if pipe trenche is deeper than 2m. Install form steel piles C200x 100x 5.2 and steel sheets to protect the walls if the trenches and holes less than 2m deep. Protect the trench walls with bearing piles if necessary. Transport excavated materials to Cau Cup disposal site by 7-10 tone trucks.

Load pre-cast RC pipes on footpath or roadside. Build on-site or use precast box drains, manholes, pump chambers, CSOs. Use 25-tonnes cranes to place the pipes into the trenches. Refill the trench with sand. Compact with tamping rammers and walk-behind rollers, layers by layers. Reinstate road surfaces using 8.5-10 tone rollers.

Construction of pumping stations (PS)

Install barriers and warning signs. Excavate to 1m deep. Use hydraulic compressors to drive Larsen sheet piles in to protect trench walls from sliding, then reinforce the walls with brace and flooring systems, and bamboo piles will be driven (25 piles/m2) to reinforce foundations. A 30cm-thick bedding layer of sand and rocks will be filled up directly for exaction trenches and levelled with excavators. Install formworks, reinforced steel, and pour concrete in. Pre-mixed concrete with waterproof admixture and fast-setting additive will be used to save time. Fill up the chamber with sand, compact with tamping rammers for reinstatement.

Upon construction completion, remove Larsen sheet piles and transport to storage areas. Install electrical and other devices for commissioning.

Dredging and embankment lining of the Cau Rao river

Construction will be carried out from the water to land, from the upstream to the downstream.

Successive dredging method will be applied. Dredge the upstream section (200 m) first, then the downstream section (275m). Dredging will be done in dry season and take place within 4-5 months (from February to August). For each section, coffer dams made of eucalytups timber and sand bags shall be built at the two ends. Pump river water out of the dredging section and the ponds for temporary diposal of dredged materials. Use excavators and buckets to dredge the river to the designed elevation, at -1.2 to -1.70 m. Stored wet dredge materials temporarily at the abandoned pond by the side Cau Rao river, directthe leakage water to run back to the Cau Rao river. Transport the dry dredge materials to the Cau Cup landfill. Isolate the dredge materials from the surrounding soil and vegeation, ensure proper drainage.

Figure 1.11: Temporary Storage Area for Dredged Sediments at Cau Rao River

For embankment lining, reinforce the foot with rocks. excavate the embankment following slope design. Apply three layers including concrete, rocks and mortar, and crushed stones on the slope. Install concrete frame size 1.2x1.2m at top part of the embankment for grass planting (total 1,439 m^2). Plant 184 willow trees along the riverside road, .

Construction of Cong Muoi bridge

Establish material storage areas and work camps at the western end of the bridge. Demolish the existing Cong Muoi, transport all wastes to and dispose at Cau Cup landfill.

Construction of bridge abutments: drill bored piles to designed levels, clean the bore holes, lower steel cages, and pour concrete.

Construction of bridge piers: drive piles to locate steel coffer dams (20.4 x 9.2 m), pour concrete to seal the bottom, pump the water out, install reinforced steel and formworks for construction of pier foundations and bodies.

Construction of bridge arches: use vibrating hammers to drive steel piles of scaffolds, installing steel scaffold system (for an area of 28 x 18 m), and pouring concrete for the bridge arches. Finally, finish the works with a handrail, bridge surface, and drainage system.

Construction of school toilets

Install fences to separate classrooms from construction sites. The new toilets at 10 schools will be constructed on vacant land. The existing toilet at Dong Son Secondary School No.1 (01 storey in an area of 43 m^2) will be demolished for construction of a new toilet. Wastes from toilet demolition will be transported to and disposed at Cau Cup landfill.

Clean the site for locating the toilet properly. Excavate foundation pits, build foundation pits with concrete, fill with soil. Install reinforced steel and formworks, and pour concrete. Finalize with plastering, painting, lay the tiles, install doors and equipment.

(ii) Civil works for Component 2

Construction of roads and bridge access road

There will be two bid packages. Package 1 cover the section from the National Highway No. 1 city bypass to Le Ky bridge. Package cover the section from the bypass to Le Ky bridge.

Site clearance. Remove 30 to 50cm top soil. Lay geotextile materials and establish 0.6-1m thick sand layer on top. Weak soil treatment where necessary. Lay two layers of geotextile materials to strengthen stability of road base. Build road base with filling materials, install drainage and sewers, road surfaces, sidewalks, etc.

Figure 1.12: Planting Grass on Slopes

Plant grass on slopes, estimated area of 15,1152.17 m^2 as shown in Figure 1.12

Residual soil of excavated organic soil will be disposed at Cau Cup landfill. Construction materials will be transported from borrow pits to material storage areas designated along construction alignments.

Construction of Le Ky bridge

Level the construction site to design levels. Establish material storage areas.

Construction of bridge abutments: Use vibration method to lower well casing to design elevation. Drill bore holes, then clean them. Lower steel casings and pour concrete, then continue with other abutments. Drive marking piles, build coffer dams (cover 10.1x33.1 m) made of steel piles, and excavate. Pour concrete to seal the bottom, pump water out to keep the foundation dry. Install reinforced steel and formworks for construction of abutment walls and bodies.

*Construction of T1 and T5 piers***:** Similar to construction of bridge abutments.

Construction of T2, T3, and T4 piers: Move the barge close to the pier. Install batter boards. Apply vibration method to put the casing to designated location. The steel cofferdam covers an area of 10.1 x 30.6 (m). The barge capacity 200 tones, dimension 7x30(m). Build bore piles similar to T1 and T5 piers.

Support construction

Abutment construction

Figure 1.13: Sample of Bridge Construction Sites

Construction of bridge spans and completion works: Build access road. Install rails and ties for launching pre-casted materials. Transport precast beams from precast yards to the bridge access road with cranes and beam carriers. Launching vehicles will take beams from the carriers and go to span points, then, lifting jacks and slides will place beams to the bridge bearing points. Construct cross beams, bridge decks, and remaining spans. Install bridge decks, handrails, finish surface layers etc.

Construction of Tay bridge

Prepare the construction site. Mobilize construction plants, materials, and equipment to the site. Drill bored holes and clean up. Lower steel casings, and fabricate concrete piles. Build steel-

pile coffer dams (covering 8.1 x 33.1 m), excavate foundation pits. Pour concrete to seal the bottom and pump the water out. Install formworks for construction of bases, bodies, and walls of abutments.

Construction of span structures: Use two 35 tonne cranes to lift precast beams from casting yards to the construction site. Finalize the handrail and the bridge deck.

During construction of the road and Le Ky and Tay bridges, a sewer route of capacity 1,999 cmd will be installed to convey wastewater from Bao Ninh peninsula to Duc Ninh WWTP. The sewer route will be made of D150 steel pipes in accordance with standard QCVN 07:2010/BXD[1] to minimize pipe breaking and wastewater leakage. The pipe will be clamped underneath Le Ky and Tay bridges.

Auxiliary Works

Existing roads will be used for access roads and service roads during the construction phase. For example, the riverside roads during dredging, and the 1.44km road.

Set up work camps, material storage areas, temporary waste storage at least 30 – 50m from any surface water sources. Workers camps for major construction works will be provided as follows: 01 camp for Cau Rao river dredging and embankment lining, and construction of Cong Muoi bridge package; two worker camps will be built for road and Le Ky bridge packages. Regarding to construction of pumping stations, drains and sewers, manholes, and outfalls, small camps will be provided within a distance of 1km.

In addition, the contractors will set up casting yards for pre-cast beams (26.5 x 27.5m at Cau Tay bridge and 36.5 x 45m at Le Ky bridge.)

1.4.4. Proposed Construction Plants and Equipment

Table 1.6: Proposed Construction Plants and Equipment

Type	Quantity (unit)	Type	Quantity (unit)
Component 1		**Component 2**	
10 tonne trucks	2	Bulldozers 110 CV140CV	1
Plate vibrators	2	Graders 110 CV	1
Steel cutters	2	Drills 4.5KW	1
Concrete pumps	2	Compressors 25T	1
Road rollers	1	Compactors 10T, 25T	1
Road scrappers/ stripping shovels	1	Self-operating hammers, capacity 2.5÷3.5 tonnes	1
Concrete breakers	5	Spreaders 50 - 60 m^3/h	1
Vertical drilling machines	5	Bore-hole drilling machines	1
Welders	3	Asphalt spraying trucks 7T	1
Excavators 0.8 m^3 BX	5	Air compressors 600 m^3/h	1
Bulldozers	1	Excavators 1.65 m^3	1
Hydraulic press	1	Digging machines	3
Self-operating hammers, capacity 2.5÷3.5 tonnes	5	Water truck 5 m3	2
Cranes capacity 16÷35 tonnes	1	Cranes for beam launching, K33-60	1
Concrete chipping hammers	2	Vibrating hammers for steel piles and steel-casing piles 60kW	1
Crane trucks (12T-25T)	1	Cranes with loading capacity 35 tonnes	1

Source: Feasibility Study, August 2016

[1]Vietnam Building Code Urban Engineering Infrastructures

The contractors will also use other equipment, machines and plants in accordance with site geological and geographical conditions, and construction progress; drainage options will be prepared for specific site conditions.

1.4.5. Power and Water Supply

The main power supply is from the national grid. The contractors will sign contracts with Electricity company of the city for power supply.

Petrol and oil will be purchased from petrol stations in Dong Hoi city.

Water supply: connect to existing local domestic water supply.

1.4.6. Workforce

The workforce will be 440 people in total, of which:

- 7 contract packages for drainage, sewers system and pumping stations construction, 30 workers in each package. At the peak time (07 contracts will be implemented in 12 months), there will be 210 workers. Priority shall be given to local workers.
- Dredging and embankment lining of the Cau Rao river, and construction of Cong Muoi bridge: 01 civil works package, requiring about 30 workers.
- Public and school toilets: 02 civil works packages, requiring 10 persons at each construction site.
- Construction of Le Ky and Tay bridges, and 1.44 km roads: 02 civil works packages, implemented simultaneously. It is estimated that 100 workers will be mobilized at peak period.

1.4.7 Excavated and Backfilling Materials, Source of Materials

1.4.7.1 Construction Materials

Quantities of excavated and backfilling materials are summarized Table 1.7 below:

Table 1.7: Excavated and Backfilling Materials

No.	Works items	Volume (m^3)	Quantity (tonne)	Transport distance (km)
Drainage and PSs				
1	Excavated materials	137,452.3	192,433	-
2	Backfilling materials using excavated materials (40% of excavated materials will be reused)	54,980	76,973	
3	Materials to be disposed off	83,222	116,546	8
4	Additional backfilling materials transported to the sites	45,817	64,144	15
Dredging and Embankment Lining of the Cau Rao River (475 m)				
1	Dredged materials to be disposed (non-reusable)	13,214	35,017	-
2	Waste from demolition of the existing Cong Muoi bridge	380	950	8
Roads				
1	Top soil removal	72,040	100,856	-
2	Top soil reused soil (for tree planting)	72,040	100,856	1
3	Filling soil	118,746	166,245	15

Source: Feasibility Study, May 2016

The estimated quantity of materials to be disposed off is 152,527 tonnes (96,815 m^3), and the total quantity of materials needed for filling is 230,389 tonnes (164,563 m^3).

In addition to pre-prepared and precast materials such as steel, iron, cement, tiles, RC drains, HDPE pipes, etc., other construction materials will be required by the project as listed in following Table 1.8.

Table 1.8: Demands for Construction Materials

No.	Item	Volume (m^3)	Quantity (tonne)	Transport distance (km)
1	Backfilling soil	164,563	230,389	15
2	Sand	110,472	243,038	20
3	Coarse rocks and crushed stones	13,241	35,751	25

Source: Feasibility Study Report, May 2016

- The required quantity of commercial concrete will be 2,800 m^3, supplied by local contractors in accordance with construction progress of the project.

1.4.7.2 Borrow Pits

The total demand of filling materials is 288,276m^3. Some borrow pits have been identified as listed in Table 1.9.

Table 1.9: Borrow Pits

Type	Location and Specification	
Soil for backfilling	-Location: Vinh Ninh commune, Quang Ninh district - Area 2.0ha; storage 19,905 m^3 - A privately owned by Mr. Le Xuan Hoa's Household;	- Site photo: 
Coarse rocks and crushed stones	- Location: Vinh Ninh commune, Quang Ninh district, Quang Binh province; - Area: 4.06 ha; - Operator: Industrial Stone Exploitation Limited Company No. 1; -Exploitable reserves: 582,774 m^3, exploitation capacity 50,000 m^3 per year; - Exploitation period: 14 years since 2013; - Total amount deposited for the environmental fund: VND 876,877,600;	- Site photo: 
Black sand, yellow sand, and medium-sized sand	- Location: Truong Xuan commune, Quang Ninh district, Quang Binh province - Area: 3ha, - Operator: Hien Ninh Transportation and Trading Ltd. Company; - Reserves 65,329m^3, exploitation capacity: 4,000m^3 per year; - Exploitation period: 17 years since 2015; Total required deposit to environmental fund: VND 274,537,000; deposited amount: VND 54,907,000;	Site photo: 

Details about operation and environmental licences and compliance of borrow pits are presented in Annex 5 of this ESIA.

As the total demanded volume of backfill materials for the project is 164,563 m^3 (230,389 tonnes) and the total borrow pit is 19,905 m^3. Thus, additional borow pits will be determined during construction phase.

Routes for transportation of materials from identified mines to Dong Hoi city are shown in Figure 1.14:

Trucks carrying sand and soil from borrow pits will run through inter-commune roads to Ho Chi Minh road, then to the provincial highway No. 9B to the National Highway No. 1A and to construction sites in Dong Hoi city. The distances are 15 - 20 km. Trucks carrying rocks and stones will follow Hoi Chi Minh road and the connection road to the city center, the transport distance is approximately 25 km.

Figure 1.14: Material Transport Routes

1.4.8. Disposal Sites

Total excavated soil and dredged materials to be disposed off is 152,527 tonnes (96,815 m^3). All of these materials will be transported to Cau Cup landfill.

The waste transportation route from construction sites to Cau Cup disposal site and existing conditions of Cau Cup landfill are illustrated in Figure 1.15.

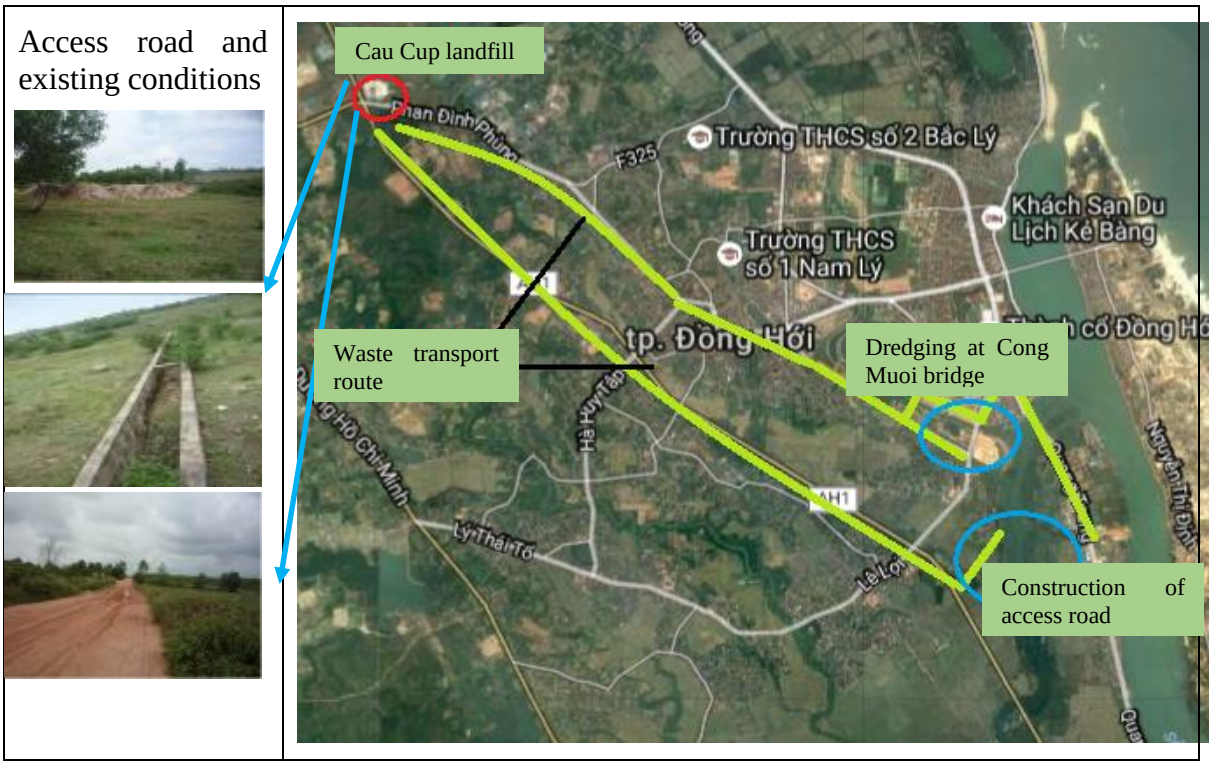


Figure 1.15: Waste Transport Routes and Existing Conditions of Cau Cup landfill

From construction sites to Thong Nhat road, trucks will pass Ton Duc Thang road or Nguyen Huu Canh road, then Tran Hung Dao road and the National Highway No. 1A to Cau Cup landfill.

1.4.9. Project Implementation Schedule

Implementation period: from 2017 to 2022. Detailed progress of each works by civil works packages is presented in Table 1.10 as follows:

Table 1.10: Works Construction Progress

Package No.	Works	Commencement	Completion
DH-3.1	Mine clearance	09 - 2016	05 - 2017
DH-3.2	Cadastral surveys and supporting in land compensation	09 - 2016	05 - 2017
	Component 1		
DH-1.1	Civil works for drainage system at Bac Ly ward	06 - 2017	06 - 2019
DH-1.2	Civil works for sewerage system, tertiary drains, and pumping stations at Bac Ly ward	06 - 2017	06 - 2019
DH-1.3	Civil works for drainage and sewerage systems, and tertiary drains at Nam Ly ward	06 - 2017	06 - 2019
DH-1.4	Dredging and embankment lining of the Cau Rao river downstream; and civil works for Cong Muoi bridge	06 - 2017	06 - 2019
DH-1.5	Civil works for school toilets	06 - 2017	06 - 2018
DH-1.6	Installation of public toilets	06 - 2017	06 - 2018
	Component 2		
DH-2.1	Civil works for the road from Nhat Le 2 bridge to Le Ky bridge, and Le Ky bridge	06 - 2017	06 - 2019
DH-2.2	Civil works for the road from Le Ky bridge to the city Bypass, and Tay bridge	06 - 2017	06 - 2019

Source: Feasibility Study – August 2016

CHAPTER 2. SOCIAL AND ENVIRONMENTAL BASELINE

2.1. PHYSICAL CONDITIONS

2.1.1. Geographical Location

Quang Binh is one of the poor coastal provinces in the Northern Central of Vietnam. Dong Hoi is a Class II city with total area of 155.71 km^2 and a population of about 113,722 people. The city is the politicals, administative, cultural, economic, education and tourism centre of Quang Binh province.

Dong Hoi is locatds at the coordinates of $17^0$21 'north latitude and $106^0$10 east longitude, 490km from Hanoi Capital to the north, and 160 km from Hue city to the south. The city is bordered with Bo Trach district to the north and the west, with Quang Ninh district to the south.and the west. The city has 12 km of coastline in the east.

Dong Hoi is located along the National Highway 1A, Thong Nhat North-South railway and Ho Chi Minh Highway.

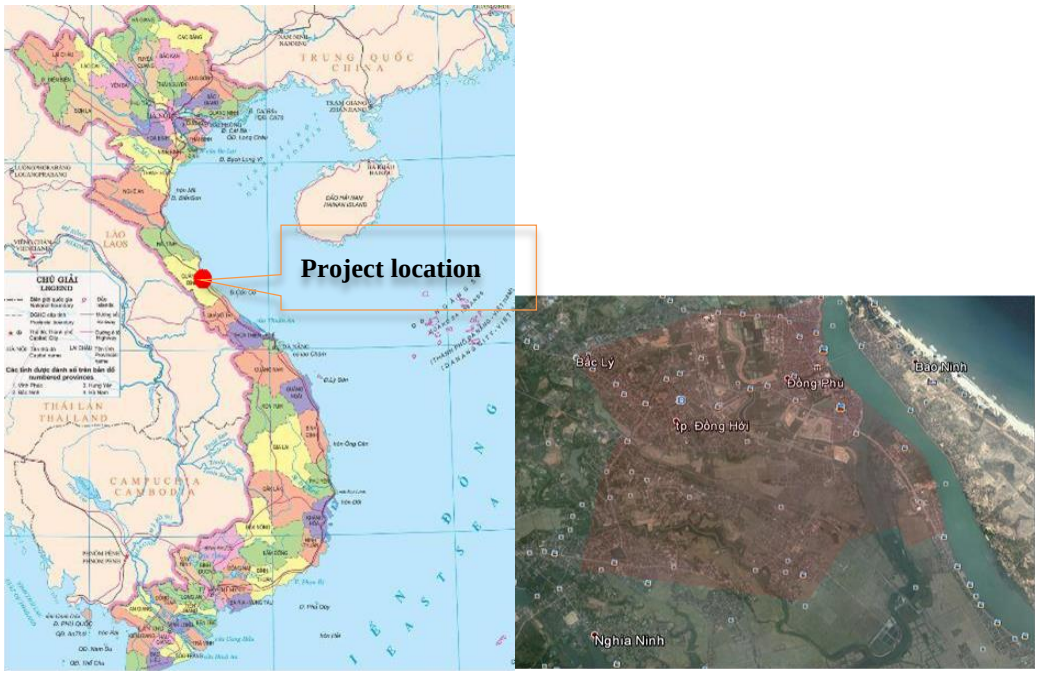


Figure 2.1 Geographical Location of Dong Hoi City

2.1.2. Topography and Geology

Quang Binh has a narrow terrain sloping from west to east, and 85% of its total land area is mountainous.

Dong Hoi city is typical coastal plains, which is low-lying with stratigraphic structure formed by accumulated marine sediments and river silt. The main formation is sandy soil and clay, and a limited amount of gravel with different sizes intersects between different soil layers. The geological survey carried out by the design consultants at 12 boreholes drilled in Dong My, Dong Phu, Hai Dinh, Phu Hai, Dong Son, Bac Ly, Nam Ly, Duc Ninh and Ninh Dong wards showed the following soil layers from the ground:

- First layer: grey semi-clay soil containing sand and organic substances with high hardness, found at the depth of 0.0 - 2.2m.
- Second layer: flexible and fine, dark-grey semi-clay soil with hard coating and different organic substances, unevenly distributed at a depth of 2-4.9m.

- Third layer: Semi-clay soil, fine and white-grey sand, hard and tough, found at the depth of 4.0 – 7.0 m.
- Fourth layer: Semi-clay soil with yellow-grey color, uneven distribution, found at the depth of 7.0 – 9.4m.
- Fifth layer: sand mixed with multi-color dust, found at the depth of 4m–9m.

Some project areas have weak soil foundation with a load carrying capacity < 1kg/cm^2.

2.1.3. Climate

Located in the monsoon tropical area of Vietnam, Dong Hoi city has high average annual temperature. Monthly rainfall is highest in October. The average monthly climate parameters are presented in the Table 2.1 below:

Table 2.1: Key Climate Parameters in the Project Area

MONTH / Parameter	1	2	3	4	5	6	7	8	9	10	11	12	AVERAGE/ TOTAL
Average T^o (°C)	25.1	17.8	18.5	21.4	26.3	29.2	30.1	29.7	29.2	26.8	25.6	24.8	25.4
Average rainfall (mm)	38.3	11.0	17.5	82.2	154.7	82.6	123.2	145.2	554.6	281.9	156.8	103.7	1744
Humidity (%)	88	90	89	87	80	72	69	75	84	86	85	85	83

Source: Hydrometeorology Data Center-MoNRE

The average humidity is around 83 – 85%, highest at 87% in winter and lowest is 50% in summers. Annually, Dong Hoi has two main wind seasons i.e. northwest - southeast winter wind, and southwest-southeast summer wind. The southwest wind, also called as "Phon" wind is dry and hot. Especially, the outside temperature may get to 40^{o}C in some summer days.

Quang Binh province, particularly coastal areas like Dong Hoi city, has been often suffered from serious typhoons and floods. Annually, one to two typhoons strike the coastal areas of the province. Most of the typhoons happen in the period from August to October. The typhoons usually often bring heavy rain, maximum daily rainfall may reach 200 -564mm. In 2011, 4 strong typhoons and floods hit the province.

In October 2013, the typhoon No. 10 (Wutip) caused severe damages to the province. In Dong Hoi, the sea dyke system was destroyed in many places by sea wave. Especially the entire sea dyke in Bao Ninh peninsular collapsed threatening the fishing villages and coastal tourism areas.

It has been anticipated that Dong Hoi could be affected severly by climate change. Recently, extreme weather conditions such as long lasting hot and dry, high tide, storms and flood occured more often. 24 floods happened in the period of 2006 – 2015.

Fallen electric pole

Electric and telephone lines

Fallen tree

Thousands of unroofed houses

Figure 2.2: Damages caused by WUTIP typhoon in Dong Hoi City (30 September 2013)

2.1.4. Hydrology

As Dong Hoi is located in the narrow coastal strip bordering with mountainous area in the west, the rivers that are sourced the mountains are relatively short and steep.

The four main water sources of Dong Hoi are Nhat Le, Phu Vinh, Cau Rao and Le Ky rivers. All of these rivers flow within Quang Binh territory.

- Phu Vinh River flows through Dong Son, Bac Nghia wards and Thuan Duc, Nghia Ninh and Duc Ninh communes (in Dong Hoi). The river originates from Phu Vinh Dam in Thuan Duc commune, and flows from the north to the south before merging with Le Ky River near the Duc Ninh wastewater treatment plant . Phu Vinh Reservoir on Phu Vinh River originates from Truong Son Mountain Range, merges with the Cau Rao River tributary in Duc Ninh commune, and with Nhat Le River near Dong Hoi Market. The topography of the basin is complicated, changed from mountainous to narrow delta. The river flows tortuously with the total basin area of 60km^2. Phu Vinh River is 16km long and 30m wide. The highest and lowest flow rates are350 m^3/s and 0.25 m^3/s, respectively. The small streams flowing into Phu Vinh Reservoir is originated from the high mountains surrounding the Phu Vinh Reservoir,flows only exist in rainy seasons.

- Cau Rao is a 4.5 km long man-made river. It follows north-south direction from the junction between Phong Thuy Canal and the argricultural drainage canal in Ly Loc field - Loc Ninh commune to Le Ky river. Cau Rao river is the main drainage channel for Bac Ly, Nam Ly, Dong Phu, Duc Ninh Dong wards and the West of Hai Dinh ward. The project will dredge 475m of Cau Rao river. The minimum distance from the dredging area on Cau Rao river to Le Ky River is 500m. Cau Rao river then joins Le Ky River and flows about 2,000m will pass through Nhat Le river before entering the sea.

- Le Ky River originates from the high mountainous area of Quang Ninh district and flows around Dong Hoi city before merging with the Nhat Le River. The river is 20km long, and the section passing through Dong Hoi is 100m wide on average. The river basin area is 90 km^2, with maximum and minimum discharges at 630 m^3/s and 3.1 m^3/s, respectively. Le Ky River receives the treated wastewater from Duc Ninh Wastewater Treatment Plant.

- Nhat Le River is 85km long. Its upstream has two branches namely Long Dai (Dai Giang) river and Kien Giang River, both of which originate from U Bo mountain, Co Roi (Truong Son commune, Quang Ninh district). At the downstream, the river receives water from Le Ky river and My Cuong river, then connecting to Cau Rao river.

The segment of Nhat Le running through Dong Hoi is characterized with semidiurnal tide regime with average amplitude of 1.4m and maximum amplitude of 1.5 m. In dry seasons, the tide's impacts spread to Phan Xa in Quang Ninh district (Kien Giang River, 45 km from Nhat Le estuary). Nhat Le River basin is 2,650 km^2 with an average annual rainfall of 2,500mm per year. The average annual flow rate is 120 m^3/s with a discharge of 47 little/s/km^2. Rainy season flow accounts for 77% of the total annual flow andthe dry season accounts for only 23%. Nhat Le river flood is mainly caused by the flood discharge from Kien Giang and Dai Giang river branches, local rainfall, and rising tide.

Figure 2.3: River and Stream System in Dong Hoi City

Dong Hoi city has following reservoirs:

- Bau Tro Reservoir locates in Hai Thanh ward (Dong Hoi city). Together with Phu Vinh Reservoir, Bau Tro is an important reservoir which supplies fresh water to Dong Hoi city with capacity of 3,000 m3/day (according to the data provided by Quang Binh Water Supply and Drainage One Member Co. Ltd). The reservoir has an area of 23.54ha.

- Khe Duyen Reservoir-Canal lies in Bac Ly ward. The area of this reservoir canal is 30 ha. Its water level in dry seasons is relatively low - around 1.5 m. Khe Duyen Reservoir Canal is a drain channel for parts of Bac Ly ward, and Nam Ly, Duc Ninh Dong, Bac Nghia wards, and Duc Ninh communes.

- Dong Son Reservoir is a regulating reservoir in Dong Son ward. It has an area of 2.52ha, serving a catchment of 32,75 ha. When there is no rain, the water level in the reservoir is always 1m lower than the top of embankment , and lower than the flood discharge outfall (600x600). The outfall is connected with the agricultural drainage canal in Dong Son ward which runs into Phu Vinh River. In case of heavy rain, Dong Son Reservoir can store an additional of 24,442 m3 of rainwater.

- Tay Huu Nghi Reservoir is located in a low-lying area, 1.5 m deep, has an area of 0.89 ha in Bac Ly ward. Water from this reservoir is dicharged into the Cau Rao river through box culverts 1.5x3m built under CCESP.

- Phu Vinh Reservoir is in Dong Son ward, Dong Hoi city, providing main fresh water for Dong Hoi city.The reservoir has an area of 4.7km^2 and storage capacity of 140 million m^3.

  The water levels in the above-mentioned reservoirs fluctuate significantly between rainy and dry seasons. In dry seasons, the water levels in the reservoirs can be only one third of that in rainy seasons.

2.1.4.1 Flooding

The CCESP in Dong Hoi city helped to reduce significant number of locations subjected to localised flooding. However, some areas are still seriously flooded bylong-lasting and heavy rains, such as some sections on Ngo Gia Tu, Huu Nghi, Hoang Sam, To Huu, Le Truc, Ly Thai To, Le Loi Road, and the road leading to Khe Duyen Reservoir, the area of Huynh Thuc Khang – Mai Luong –flyoverbridge abutment, downstream of Cau Rao River in Duc Ninh commune, and the northern area of Vietnam-Cuba Hospital in Bac Ly ward. Besides, Dong Hoi city still has many locations subjected to small localisted flooding in sparsely distributed residential areas or low - traffic density routes, and areas far from the center. The main reason for flooding is due to groundlevel in these areas are lower than the main roads so as water cannot be drained. Flooding usually lasts for 4-6 hours, and deepest water level is 0.5m . Flooding mainly affect traffic and traffic safety, people's lives, damages to properties, trees and animals. After floods, poor environmental sanitation conditions may result in epidemics such as diarrhea, skin diseases and sore eyes.

2.2. EXISTING ENVIRONMENTAL QUALITY

2.2.1. Air Quality and Noise

According to the Environmental Monitoring Report prepared in 2015[2], the contents of dust CO, NO_2, and SO_2 are all within the allowable limits in QCVN 05:2013/BTNMT[2]. All measured noise level measured were higher than the allowable limits in QCVN 26:2010/BTNMT[3], supposedly caused by high traffic density.

Table 2.2: Air Quality in Dong Hoi City

No.	Monitoring Station	Monitoring Period	Parameter				
			Dust (mg/m^3)	CO (mg/m^3)	SO_2 (mg/m^3)	NO_2 (mg/m^3)	Noise (dBA)
1	Intersection of city bypass (intersection of Ha Huy Tap and Dong Hoi city bypass road)	Phase I	0.10	4.53	0.007	0.056	76.0
		Phase II	0.07	2.20	0.08	0.073	82.6
		Phase III	0.06	3.34	0.07	0.055	80.7
		Phase IV	0.007	4.46	0.05	0.073	80.5
2		Phase I	0.06	4.53	0.10	0.074	79.7

[2] Implemented by Quang Binh DONRE
[3] The National Standard on quality of the ambient air

	Provincial post office intersection	Phase II	0.06	4.40	0.10	0.091	81.5
		Phase III	0.05	5.52	0.07	0.091	84.7
		Phase IV	0.06	4.45	0.07	0.074	82.8
	Permitted by QCVN standard		0.3 (*)	30 (*)	0.35 (*)	0.2 (*)	70 (**)

Source: Environmental monitoring report 2015, Quang Binh DoNRE

Note: (*) QCVN 05:2013/BTNMT- National technical regulations on ambient air quality
+ (**) QCVN 26 :2010/BTNMT –National technical regulations on noise level
+ Monitoring phase 1: from 11/3 to 01/4/015. Monitoring phase 2: from 12/5 – 03/6/2015. Monitoring phase 3: from 25/8 – 30/9/2015. Monitoring phase 4: from 06/11 – 19/12/2015.

The resutls of air quality monitoring carried out during ESIA preparation are presented in Table 2.3 below.

Table 2.3: Air Quality on the Roads in the Project Area

Monitoring Station	Sample	Parameter				
		Dust (mg/m^3)	**CO (mg/m^3)**	**SO_2 (mg/m^3)**	**NO_2 (mg/m^3)**	**Noise (dBA)**
The intersection of Quang Trung road and the link road to Nhat Le Bridge	K1	0.08	2.296	0.03	0.036	69.2
Intersection of the earth road and road link to Nhat Le 2 bridge	K2	0.09	3.444	0.05	0.038	68.4
Le Loi road and Cong Muoi Bridge	K3	0.09	2.296	0.03	0.034	68.8
Intersection of Le Loi and Vo Trong Binh roads	K4	0.08	2.290	0.05	0.036	67.4
Intersection of Ly Thai To and Chu Van An roads	K5	0.09	2.290	0.03	0.034	68.7
Intersection of Le Thanh Dong and Truong Pap roads	K6	0.08	1.145	0.03	0.036	66.7
pumping station on Phan Dinh Phung Road	K7	0.07	2.296	0.03	0.034	66.6
Tran Hung Dao road, 200m from Cau Rao bridge	K8	0.08	2.296	0.03	0.034	69.8
Thong Nhat road	K9	0.07	1.145	0.03	0.035	67.5
QCVN allowable limits		0.3 (*)	30 (*)	0.35 (*)	0.2 (*)	70 (**)

Source: Environmental monitoring results in March 2016 of the Project

Note: (*) QCVN 05:2013/BTNMT- National technical regulations on air quality and ambient environment
+ (**) QCVN 26 :2010/BTNMT –National technical regulations on noise
+ Sample taken on 18/3/2016

The above table showed that the values of all tested parameters are within the allowable limits.

The results of environment monitoring carried out in Duc Ninh WWTP area in January 2016 are presented in the Table 2.4 below:

Table 2.4: Air quality in Duc Ninh WWTP Area

No.	Monitoring Station	**Parameter**			
		Temperature (^0C)	**CO (mg/m^3)**	**SO_2 (mg/m^3)**	**NO_2 (mg/m^3)**
1	**K_1** (close to fence in the southern end of the WWTP)	34	1.11	0.03	0,018

2	**K_2** (close to the south fence inside the WWTP)	35	1.10	0.03	0,018
3	**K_3** (at a household in Duc Ninh commune)	35	1.10	0.03	0,018
QCVN 05 : 2013/BTNMT (one hour in average)		**-**	**≤ 30**	**≤ 0.35**	**≤ 0.2**

Source: Environmental monitoring report of Duc Ninh WWTP in January 2016

Data in the above table shows that the concentration of CO, SO_2, NO_2 in Duc Ninh WWTP area including the surrounding residential area are within the allowable limits.

2.2.2. Surface Water Quality

According monitoring results provided by Quang Binh Center of Environmental Monitoring and Technique in 2015 as shown in Table 2.5, all parameters of the water samples taken from Nhat Le River are within the allowable limits in QCVN 08-MT/2015/BTNMT.

Table 2.5: Surface Water Quality at Nhat Le Bridge Area

No.	Parameter	Unit	Nhat Le Bridge				QCVN 08-MT: 2015/BTNMT - Column B_2
			Phase 1	Phase 2	Phase 3	Phase 4	
1	pH		6.71	7.31	7.45	7.39	5.5 – 9
2	T°	°C	24.8	30.9	31.2	29.2	-
3	TSS	mg/l	19	22	24	23	≤ 100
4	DO	mg/l	6.19	6.14	6.46	6.42	≥ 2
5	BOD_5	mg/l	12.7	14.2	13.6	11.4	≤ 25
6	COD	mg/l	19	25	21	18	≤ 50
7	Fe	mg/l	0.15	0.68	0.17	0.22	≤ 2
8	Phosphate (P)	mg/l	0.09	0.02	0.06	0.07	≤ 0.5
9	Nitrate (N)	mg/l	0.7	0.5	0.4	0.4	≤ 15
10	Ammonia (N)	mg/l	0.03	<0.025	0.09	0.14	≤ 0.9
11	Arsenic	mg/l	$<1.84x10^{3}$	$<1.84x10^{3}$	$<1.84x10^{3}$	$<1.84x10^{-3}$	≤ 0.1
12	Cadimi	mg/l	$<0.31x10^{-3}$	$<0.31x10^{-3}$	$<0.31x10^{-3}$	$<0.31x10^{-3}$	≤ 0.01
13	Pb	mg/l	$8.78x10^{-3}$	$<1.22x10^{-3}$	$3.86x10^{-3}$	$2.17x10^{-3}$	≤ 0.05
14	Hg	mg/l	$<0.89x10^{-3}$	$0.54x10^{-3}$	$0.47x10^{-3}$	$0.50x10^{-3}$	≤ 0.002
15	Coliforms	MNP/100ml	23	2.780	2.030	980	≤ 10000

Source: Environmental monitoring report in 2015, Quang Binh DONRE

Note: Sampling taken time:

+ Sampling phase 1: from 11/3 to 01/4/2015.
+ Sampling phase 2: from 12/5 to 03/6/2015.
+ Sampling phase 3: from 25/8 to 30/9/2015.
+ Sampling phase 4: from 06/11 to 19/12/2015.

QCVN 08-MT/2015/BTNMT: National technical regulations on surface water quality (column B_2)

The water quality data Le Ky River (receiving treated wastewater from Duc Ninh WWPT) shown in Table 2.6 also indicated that all of the parameters are within allowable limits of QCVN 08-MT:2015/BTNMT- Column B1.

Table 2.6 Surface Water Quality of Le Ky River

No	Parameter	Unit	Results		QCVN 08-MT: 2015/BTNMT Column B_1
			M_1	M_2	
1	pH		6.82	6.64	5.5 – 9
2	TSS	mg/l	5	5	≤ 50
3	BOD_5	mg/l	<1	<1	≤15

No	Parameter	Unit	Results		QCVN 08-MT: 2015/BTNMT Column B_1
			M_1	M_2	
4	COD	mg/l	<5	5	≤ 30
5	Ammonia (N)	mg/l	0.06	0.05	≤ 0.9
6	Nitrate (N)	mg/l	0.7	0.5	≤ 10
7	Phosphate	mg/l	0.02	0.03	≤ 0.3
8	Fe	mg/l	0.42	0.43	≤ 1.5
9	Chloride	mg/l	16.7	15.9	≤ 350
10	Coliform	MPN/100ml	200	380	≤ 7.500

Source: Environmental Engineering and Monitoring Center of Quang Binh

Note: - Sampling date: 1/12/2015. Sampling location:

+ M1: 100m downstream of Duc Ninh discharged point;
+ M2: 200m from discharged point toward upstream.

- QCVN 08-MT:2015/BTNMT- Column B1: regulation on surface water quality for irrigation or other purposes with similar quality requirements, or for the using purposes as in B2)

The water analysis results are presented in Table 2.7:

Table 2.7: Surface Water Quality

No	Parameters	Unit	Results					QCVN 08-MT: 2015/BTNMT Column B_1
			M_1	M_2	M3	M4	M5	
1	pH		7.84	7.21	7.23	7.54	6.89	5.5 - 9
2	T°	°C	19.9	20.1	19.9	20.4	19.9	
3	Salinity	‰	16.3	7.6	7.5	14.6	0.0	
4	DO	mg/l	6.11	5.66	5.98	7.01	4.55	≥ 5
5	TSS	mg/l	79	81	149	41	155	50
6	COD	mg/l	66	53	34	28	39	30
7	BOD_5	mg/l	39.4	31.8	21.5	18.2	23.4	15
8	Ammonia	mg/l	0.31	0.64	0.66	0.1	0.28	0.9
9	Fe	mg/l	0.07	<0.01	<0.01	0.02	0.51	1.5

Note:

- Samples taken on 18/3/2016
- Sampling locations:
  + M1: Surface water in Cau Rao River at Cong Muoi
  + M2: Surface water at the confluence of Le Ky and Cau Tay River
  + M3: Surface water at the confluence of Le Ky River and Duc Ninh - Phu Hai
  + M4: Surface water at the confluence of Nhat Le and Cau Dai
  + M5: Surface water in Khe Duyen Reservoir

According to the above table, the parameters of TSS, COD, and BOD5 of the water samples taken from Cau Rao and Le Ky rivers are 1.5 to 3 times higher than the permitted levels stipulated in the national technical regulations QCVN 08-MT:2015/BTNMT column B1, which is considered as being caused by the domestic wastewater from some sewers. The analysis results show that the water in Cau Rao River at Cong Muoi section and in Le Ky River has salinity from 7.5 to16.3‰.

The water quality analysis results of some reservoirs in the project area, which will be designed to receive water discharged from the proposed outfalls, are presented in Table 2.8.

Table 2.8: Water Quality of the Lakes in the Project Areas

No	Parameters	Unit	Results	QCVN 08-MT: 2015/BTNMT Column B_1
			M6	
1	pH		6.89	5.5 - 9
2	T°	°C	29.5	
3	Salinity	‰	-	
4	DO	mg/l	6	≥ 5
5	TSS	mg/l	133	50
6	COD	mg/l	45	30
7	BOD_5	mg/l	22.4	15
8	Ammonia	mg/l	0.4	0.9

Note:
- Sampling time: 28/8/2016
- Sampling location:
  + M6: Surface water of Dong Son Reservoir

The results showed that the TSS and BOD_5 in the water samples taken at Dong Son are 1.5 to 3 times higher than the allowable limits specified in QCVN 08-MT:2015/BTNMT Column B1, supposed tot be caused by the surfacerunoff from surroundings area to the lakes.

2.2.3. Domestic Wastewater Quality

The quality of domestic wastewater before and after being treated at Duc Ninh WWTP is presented in Table 2.9:

Table 2.9: Wastewater Quality

No	Parameter	Unit	Monitoring Station				TCVN 7222:2002 (Grade 2)
			Phase I/2016		Phase II/2016		
			T_1	T_2	T_1	T_2	
1	pH	-	6.72	7.54	8.08	7.89	6 - 9
2	TSS	mg/l	111	24	103	21	10-30
3	BOD_5 (20^0C)	mg/l	61	21.3	126	29.7	10 - 30
4	Total phosphate	mg/l	1.91	1.82	4.3	1.14	5 - 12
5	Total nitrogen	mg/l	19.0	10.5	34.4	7.4	15 - 30

Note:

- Sampling location:
  + T_1: Wastewater at the intake of the treatment system
  + T_2: Wastewater at the outfall of the treatment system

- TCVN 7222:2002 (General environmental requirements for central domestic wastewater treatment plants – Grade 2

The monitoring results for the wastewater taken from the treatment plant outfall showed that the parameters in the treated wastewater are within the allowable limits.

2.2.4. Groundwater quality

The ground water quality in the project area monitored in 2015 presented in Table 2.10 showed that the concentration of COD, hardness, chloride, arsenic, etc. are within the limitations required by QCVN 09: 2008/BTNMT. Only Coliform is 2-3 times higher than the permitted standard.

Table 2.10: Ground Water Quality in the Western Area of Nhat Le River

No	Parameters	Unit	Results		QCVN 09: 2008/BTNMT
			Phase 2	Phase 4	
1	pH		6.52	6.48	5.5 – 8.5
2	Hardness	mg/l	57	63	≤ 500
3	TS	mg/l	87	91.4	≤ 1500
4	Sulphate	mg/l	3	14	≤ 400

5	FE	mg/l	0.26	0.22	≤ 5
6	Chloride	mg/l	9.6	12.4	≤ 250
7	Arsenic	mg/l	$<1.84x10^{-3}$	$<1.84x10^{-3}$	≤ 0.05
8	Nitrite (N)	mg/l	0.016	<0.006	≤ 1.0
9	Ammonia (N)	mg/l	0.06	<0.025	≤ 0.1
10	Cd	mg/l	$<0.31x10^{-3}$	$<0.31x10^{-3}$	≤ 0.005
11	Pb	mg/l	$<1.22x10^{-3}$	$<1.22x10^{-3}$	≤ 0.01
12	Hg	mg/l	$0.57x10^{-3}$	$0.48x10^{-3}$	≤ 0.001
13	Coliform	VK/100ml	10	6	≤ 3

Source: Environmental monitoring report in 2015, Quang Binh DoNRE

Note:

+ QCVN 09: 2008/BTNMT – National technical regulations on ground water quality
+ Sampling location: Dong Hoi city, coordinates N:17^{0}26'07.9"- E:106^{0}38'34.7".
+ Sampling phase 2: from 12/5 to 03/6/2015.
+ Sampling phase 4: from 06/11 to 19/12/2015

2.2.5. Sediment Quality

The sediment quality analysis results for the bed of Cao Rao River, where the dredging works will be implemented, are presented in Table 2.11.

Table 2.11: Sediment Quality for Cau Rao River Area

No	Parameters	Unit	Results			QCVN 43: 2012/BTNMT
			TT1	TT2	TT3	
1	Cu	mg/kg	7.63	5.67	11.8	197
2	Zn	mg/kg	40.5	30.7	50.9	315
3	Pb	mg/kg	25.6	20.5	38.3	91.3
4	Cd	mg/kg	1.04	KPH (1.0*)	1.41	3.5
5	As	mg/kg	0.117	0.109	0.143	17
6	Hg	mg/kg	< 0.033	< 0.033	< 0.033	0.5

Note:

+ QCVN 03: 2012/BTNMT – National technical regulations on sediment quality.
+ Sampling time: 30/3/2016.
+ Sampling locations:

- TT_1: Sediment sample of Cau Rao River, Cong Muoi section (near the bank) (N: 17^{0}27'24.5" - E: 106^{0}37'30.6");
- TT_2: Sediment sample of Cau Rao River, Cong Muoi section (middle of the river) (N: 17^{0}27'24.3" - E: 106^{0}37'30.3");
- TT3: Sediment sample of Le Ky River at the downstream section (N: 17^{0}26'43.4" - E: 106^{0}37'47.7").

Table 2.11 shows that all the sediment samples have heavy metal contents within allowable limits specified in QCVN 43: 2012/BTNMT. The salinity of the two sediment samples taken at the dredged area and at the location to be dredged under CCSEP is presented in Table 2.12.

Table 2.12: Salinity in Sediment from Cau Rao River

No	Parameter	Unit	Result	
			TT4	TT5
1	Dissolved salt	‰	10.4	10.7

Note: - Monitoring time: 27/6/2016;

- TT4: Sediment sample taken at Cau Rao River segment dredged under CCSEP 1 (N: 17027'47,6" - E: 106036'45,8")

- TT5: Sediment sample taken from Cau Rao River, at Cong Muoi segment (N: 17027'24.3" - E: 106037'30.3");

According to the analysis, the sediment in Cau Rao River is slightly salinized with 10.4 – 10.7‰. It may be caused by the intrusion of tidal water from Nhat Le estuary. This result is

similar to the sediment salinity analysis of Cau Rao River in the EIA of CCESP prepared in 2014, which showed the salinity of the sediment was 10.8‰.

2.2.6. Biological Resources

2.2.6.1. Terrestrial Biological Resources

Quang Binh province is located in the North Truong Son mountain range area which has diverse and unique flora and fauna. The province has total forest area of 486,688 ha, including 447,837 ha of natural forest. The forested areas, including the Phong Nha – Ke Bang National Park and Khe Net and Giang Man Mountain Natural Reserve Zone. Flora is diverse in species with 138 families, 401 branches, and 640 species. Wood reserve is high with about millions cubic meters with many valuable and rare wood species such as ion wood, sindora wood and ebony, etc. There are 493 fauna species, among of which there are 67 animal species, 48 reptile species, 297 birds species and 61 fish species. There are many rare and endangered species such as Ha Tinh clam, bear, tiger, sao la, Vooc Ha Tinh, bear, tiger, Sao La, Mang Lon, pheasant, etc.

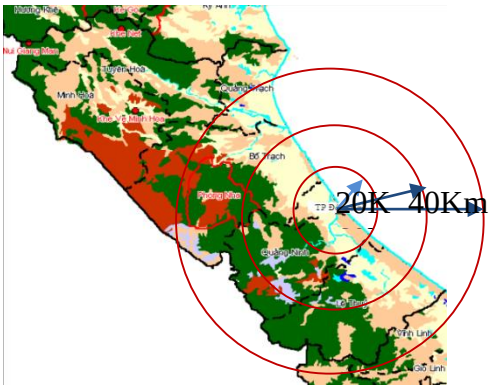


Figure 2.4: Locations of the Natural Reserve Zones in Quang Binh

These forested and nature reservces are located in the mountainous districts in the west of Quang Binh province, which is about 45 km from Dong Hoi. The city is located on the eastern coasts with very simple urban biological settings.

The temporary disposal site for the dredged materials from Cau Rao River are the existing abandoned aquaculture ponds at riverside. There are some grass, frogs, toads and reptiles species in this area. There isno known rare or endangered species. The river bank section where the dredging works will be conducted only has some grass, earthworms, grasshoppers …

The river section to be dredged and the bandoned aquaculture ponds at Cau Rao River bank

The Cau Cup landfill site was closed in 2008 and the site has been reinstated partly with vegetation covers and trees including grass, rubber and eucalyptus. There are also rat, tiny reptiles, and no rare or endangered species.

Vegetation at the disposal site

Planted eucalyptus near the disposal site

Currently, the area along the proposed road alignment are mainly rice fields, aquaculture ponds, and abandoned land irrigation canals. There are rice, grass, some wood trees including casuarinas and acacia aneuera in the areas. Mimosa pigra, an invasive species has also been observed at some locations in the area. Small reptiles area supposed to present in this area.

Mimosa pigra

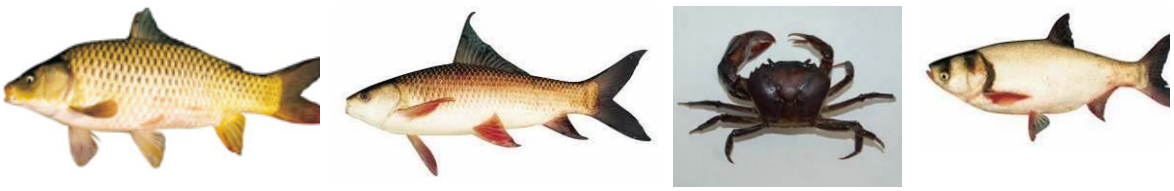
Irrigation canal

There are no rare species in this urban setting.

2.2.6.2 Aquatic Biological Resources

According to results of the survey conducted by Quang Binh Provincial Department of Sciences and Technology[4], on the aquatic system of Dong Hoi city, the aquatic resources in the project area are characterized as below:

- In Le Ky River, the river bed has oyster[5], little fuzz earthworm, popular fish species such as tench (chep), bream (me), crucian carp (giec), snake-head, crab, shrip as in Figure 2.5. Aquatic plants are dominated by blue algae and diatom species. Besides, there are also some ephemera species such as protozoa, mollusca, nemathelminthes, arthrapoda, annelida. Blue algae (tao lam) accounts for 40 – 65% of total algate in the water. The aforesaid fishes are all of high economic value, not including in the preservation list; hence, people can exploit them.



Tench fish Carp fish Crab Bream fish

Figure 2.5: Some Aquatic Species in Le Ky River

- In Cau Rao River: 1) the river bed has oyster species and little fuzz earthworm; (2) popular fish species such as tench (chep), bream (me), crucian carp (diec),…; (3) Aquatic plants are

[4] *https://skhcn.quangbinh.gov.vn/3cms/upload/khcn/File/SachKhoaHoc/410.../3.doc*
[5] *Socio-economi, Environment survey of the project in 2016*

dominated by blue algea and diatom species; (4) there are also some ephemera species such as Bosmina, Bosminopsis, Chydorus, Arcella; (5) Mosquito larva. The aquatic ecosystem in this river is poorer than Le Ky River in terms of quantity and number of species.

The results of aquatic biological sampling conducted by ESIA consultant at Cau Rao and Le Ky Rivers are summarised belowand detailed in Annex 2:

Table 2.13: Features of Aquatic System in the Project Area

Parameter	Unit	Range	Average
Number of plankton flora	Species	35	-
Number of plankton fauna	Species	20	-
Number of big spineless species	Species	15	-
Density of plankton flora	Individual /L	1,175 - 34,243	22,000
Density of plankton fauna	Individual /m^3	7,900 – 14,800	11,350
Density of big spineless species	Individual /m^2	50 –340	195

Note: Monitoring time: 27/6/2016

Detailed results of aquatic sample analysis are presented in Annex 2.

The data in Table 2.13 show that species found includes fresh and brackish water species. Based on the species composition, number, dominant species, indicative species, it is possible to note that the aquatic environment and the river bed of the sampling areas have been moderately polluted by organic substances. The river bed is typically sediment and sand.

In addition, as Cau Rao river joins Le Ky river which then run into Nhat Le river, the 2km-long section from the river junction point to Nhat Le sea mouth are formed with alluvial grounds where brine and brachkish species live and reproduce. There are about 100 economic-value species, including fish, crustaceans (shrimp, crab), molluscous, snakes, and some vegetation types, often migrate to Nhat Le sea mouth. However, migration of such species to Cau Rao and Le Ky rivers is rare.

In general, the flora and fauna system in the project area are poor in both species and quantity with no species listed in the Vietnamese Red Book, or in the list of species that catching is limited.

2.3. SOCIO-ECONOMIC CONDITIONS

2.3.1. Land Use

Dong Hoi city has 16 administrative units, including 10 wards and 6 communes with a total land area of 155.71 km², including 55.47 km² of inner city area and 100.24 km² of suburban area. Figure 2.6 below is the administrative map of the city:

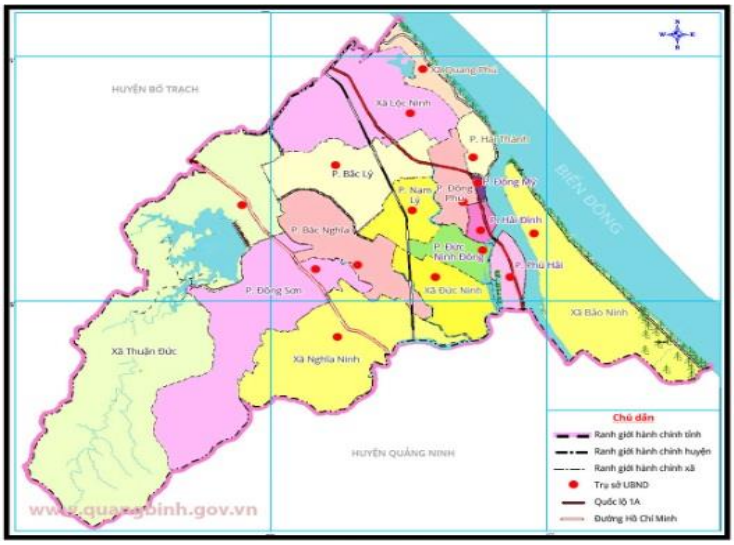


Figure 2.6: Dong Hoi City Administrative Map

The existing land use of Dong Hoi city is presented in Table 2.14:

Table 2.14: Land Use Scheme of Dong Hoi City

No.	Land use	2015	
		Area (ha)	%
1	Agriculture, forest and aquaculture land	9,967.23	63.94
1.1	Agricultural land	2,982.59	19.13
1.2	Forest land	6,582.45	42.23
1.3	Aquaculture land	396.25	2.54
1.4	Other agricultural land	5.84	0.04
2	Non - agricultural land	5,095.06	32.69
2.1	Residential land	574.89	3.69
	Rural	225.76	
	Urban	349.13	
2.2	Special use	3,544.15	22.77
	Offices	36.76	0.24
	National defense	160.36	1.03
	Security	609.80	3.91
	Public services	209.78	1.35
	Non-agricultural land for production and services	552.80	3.55
	Public use land	1.974.66	12.67
2.3	Use for Religious belief	4.21	0.03
2.4	Tombs & cemetery	246.88	1.58
2.5	Rivers& streams	606.43	3.89
	Land surface for special use	116.57	0.75
2.6	Other non-agricultural land	1.94	0.01
3	Unused land	525.04	3.37
	Total	15,587.34	100

Source: Statistical Yearbook 2015 for Dong Hoi City

Land use structure: most of the land is agriculture, forest, and aquaculture land which accounts for the highest rate of 63.94%, of which the majority is agriculture and forest land, aquaculture land counts for only 2.54%; residential land makes up small percentage of 3.69%.

2.3.2. Population, Occupation and Income

Dong Hoi city has 116,903 people with 32,528 households of which 71.18% live in urban areas, and 28.82% living in rural areas.

Table 2.15: Population of Dong Hoi city by End of 2015

NO	COMMUNE/WARD	POPULATION			AREA (KM^2)	DENSITY (person/km^2)
		TOTAL	MALE	FEMALE		
1	Hai Thanh	5,553	2,773	2,679	2,780	2,268
2	Dong Phu	10,177	5,078	4,915	5,099	2,664
3	Bac Ly	17,493	8,729	8,574	8,764	1,758
4	Dong My	2,934	1,458	1,418	1,476	5,249
5	Nam Ly	14,165	7,068	6,932	7,097	3,535
6	Hai Dinh	3,690	1,841	1,811	1,849	2,692
7	Dong Son	8,645	4,314	4,220	4,331	442
8	Phu Hai	3,775	1,884	1,804	1,891	1,208
9	Bac Nghia	7,530	3,753	3,662	3,777	1,005
10	Duc Ninh Dong	5,256	2,623	2,517	2,633	1,890
11	Quang Phu	3,080	1,523	1,532	1,557	955
12	Loc Ninh	8,476	4,230	4,164	4,246	636
13	Bao Ninh	9,278	4,630	4,560	4,648	525
14	Nghia Ninh	4,806	2,399	2,352	2,407	306
15	Thuan Duc	4,153	2,072	2,044	2,081	92
16	Duc Ninh	7,892	3,938	3,824	3,954	1,420
Total		**116,903**	**58,313**	**58,590**	**155,87**	**750**

Source: Statistical Yearbook 2015 for Dong Hoi City

According to the survey results[6], 71.18% of the population live in urban areas and 28.82% live in rural areas. As regards to the working age (ranging from 18 to 60 years old), 66,185 urban residents are within the working age (31,445 females), of which 42,342 people working in various economic sectors, 8,045 people working in the agriculture sector, 16,852 people working in the industrial and construction sector, and 17,445 people working in the tourism and service sector (equipment to 19.0%; 39.8% and 41.2% respectively).

Table 2.16: Occupations of 200 Surveyed Households

Unit: %

Ward/ commune	Unable to work	Trade, Service	Agriculture forestry, aquaculture	State official staff	Student	Handicraft	Hired labor	Unemployed	Chilren < 6 yrs old	Others
Total %)	**4.2**	**46.1**	**1.4**	**6.9**	**19.8**	**0.5**	**4.9**	**4.0**	**7.1**	**4.9**
Dong Phu	2.3	45.1	3.8	6.0	18.0	0.8	5.3	7.5	6.8	4.5
Dong My	4.0	48.0	0.0	4.0	17.3	0.0	2.7	8.0	13.3	2.7
Hai Thanh	3.1	61.5	0.0	3.1	18.5	0.0	3.1	1.5	9.2	0.0
Dong Son	4.7	40.7	1.2	9.3	14.0	0.0	5.8	1.2	11.6	11.6
D.Ninh Dong	6.8	41.5	0.6	9.1	20.5	0.0	6.3	3.4	6.8	5.1
Bac Nghia	2.8	44.0	3.7	6.4	20.2	2.8	2.8	6.4	4.6	6.4
Phu Hai	3.3	50.8	0.0	4.9	26.2	0.0	6.6	3.3	3.3	1.6
Phu Hai	3.0	60.0	0.0	4.0	20.0	0.0	3.0	2.0	7.0	1.0
Bac Ly	4.7	40.1	1.2	9.3	22.7	0.6	5.8	1.7	6.4	7.6
Nam Ly	6.9	44.4	0.0	8.3	22.2	0.0	5.6	2.8	5.6	4.2
Hai Dinh	3.4	46.0	3.4	5.7	17.2	1.1	5.7	6.9	5.7	4.6

Souce: Socio-economic survey of the project in 2016

According to the results of surveys and in-depth interviews, main occupations of the surveyed people are trading and service (46.1%), State official and staff, agriculture – forestry – aquaculture, and industry, hand craft, and construction rank at the least.

[6] Source: Survey data, April 2016

The social survey also shows that the rate of poor households[7] fluctuates from 0% (Hai Dinh and Dong My wards) to 2.37% in Duc Ninh commune. The HHs' average incomes are from VND 2,000,000 – 4,000,000 per person per month, which is lower than the average income of the city in 2015 which is VND5,600,000 per person per month.

2.3.3. Economic

In 2015, agriculture, forestry and fisheries accounted for 5.7% of the economy, industry and construction 39.9%, and services 54.4% services. It is expected that by 2020, agriculture, forestry and fisheries will account for 3.3%, industry - construction 42.5% and services 54.2%. The income per capita in 2015 reached VND 67,500,000 per year (equivalent to USD 3,000), and is expected to reach VND 147,000,000 per year (equivalent to USD 5,800) by 2020.

Tourism: Dong Hoi is one of the popular tourist destinations in the central coastal region of Viet Nam. Dong Hoi has nice beaches, Phong Nha-Ke Bang National Park (recognized as a world natural heritage by UNESCO in June 2003), Phong Nha and Thien Duong caves – which are 45km from Dong Hoi city. Tourism activities bring significant revenue for Quang Binh province in general and Dong Hoi city in particular. According to the statistics of Quang Binh tourism sector, the province has 280 big & small hotels with 3,500 rooms and 3,000 restaurants.

Industry: The main industries in Dong Hoi city includee processing (seafood and meat), textile, furniture - making, ceramic, mining (coal, ore, rock, sand) which serve the economic development and daily life of the province. Dong Hoi is the industrial center of the province, therefore most of the factories are located in the city.

Agriculture and aquaculture: Although being an urban city, Dong Hoi also has rural areas with six communes mainly operating in agriculture, forestry and aquaculture. The agricultural land area of the city is 2,780 ha including 1,771.6 ha of annual crop land (with 1,229 ha for rice), 542 ha for upland crops (corn, soybeans, peanuts, v.v.), and 1,009 ha for perennial plants (fruit trees, tea , v.v.); the area of forest land is 6,687 ha, and of aquaculture is 453 ha. Agricultural products include rice, corn, bean, sweet potato, sesame, cassava, peanut, soybean, vegetables, and fruits (coconut, cashew…)

2.4. INFRASTRUCTURE AND SERVICES

2.4.1. Education & Healthcare

In 2011, 43 education facilities were registered including: one university (established in 2005), five high schools, three vocational schools, one technical school, 18 secondary schools, 22 primary schools and 159 kindergartens. According to the socio-economic survey, 90% of the population in the project area have graduated primary school to university or higher levels. Amongthese, 60% have finished secondary schools. Only 8% graduated from university or college. The illiterate rate is 0.2% and not much different between the surveyed communes.

The existing healthcare facilities in the project area are listed in the below table. The province had 349 doctors in 2012.

Table 2.17: Healthcare Facilities in Dong Hoi City

NO.	INDEX	2011	2012
I.	Healthcare facilities	30	30
	Hospital	3	3
	Healthcare stations	16	16
	Recuperation centers	10	10

[7] Income of poor Households at city wards is less than VND 1,000,000 per person per month and VND 800,000 per person per month at communes.
Pro-poor Households: from less than VND 1,000,000 to 1,300,000 per person per month at city wards from VND 800,000 to VND 1,000,000 per person per month at communes.

	Epidemic prevention team	1	1
	Total number of sbed	881	986
II	Healthcare staff		
	Total	1017	1116
	Doctor	343	349
	Nurse	350	465
	Other	324	302

The number of cases affected from waterborn diseases including dysentery, diarrhea and petechial fever are in 2011 & 2012 are listed in the below table.

Table 2.18: Waterborn Diseases in Dong Hoi City

DISEASES	**2011**	**2012**	**2012/2011(%)**	**Average**
Dysentery	261	189	72.41	228
Diarrhea	394	672	92.55	497
Petechial fever	14	10	71.4	66
Total disease cases	1063	1178	110.8	1734
Percentage	0.942%	1.041%	-	1.538%

Source: Dong Hoi City Preventive Medical Center, September 2013

The socio-economic survey shows that 28.7% of the surveyed households suffered from illness in the past two months. This rate is relatively high, raising concern about the local people's health in the context of better health standards and healthcare conditions.

According to the interviewees, five main factors causing negative impacts on local people's health are polluted water, pollution in their residential areas, unsafe food, and epidemics resulting from bad habits. Among them, 44.3% considered unsafe food and pollution in the residential areas as the major factors. This is also a common fact in other provinces and cities.

2.4.2. Transportation

The Highway No. 1A has 11.96km running through the center of Dong Hoi city. It is the inter-province transportation route and also the main urban road of the city. The asphalt road surface has a good quality. Ho Chi Minh Highway passes through the West of city. The inter-provinces bus station locates in Tran Hung Dao Road. The number of cars and buses operating at this station is 3,400 turns per year in average.

The North - South national railway has 11.29 km passing through Dong Hoi city, the railway station is located in Nam Ly ward. the number of passengers is about 162,000 turns per year.

Nhat Le Seaport has a 50m-long dock to accommodate shipments up to 200 tonnes. 18,961 ton of goods, mainly agricultural and forestry products and recycled materials, passing this port each year.

Dong Hoi Airport is located in the North of the city at Loc Ninh commune. It has been upgraded and rehabilitated to serve air planes A320/A21 or similar ones.

The inner city has 131km of road and 74 km of alleys. From highway No. 1A, the city bypass and Ho Chi Minh Highway, there is a road network with 81.5 km in 74 routes connecting the residential areas with city centresAmong these, 45.27 km asphalt covered road accounting for 56%, and 36.265 km aggregate road accounting for 44%. Figure 2.5 presents the road map of the city.

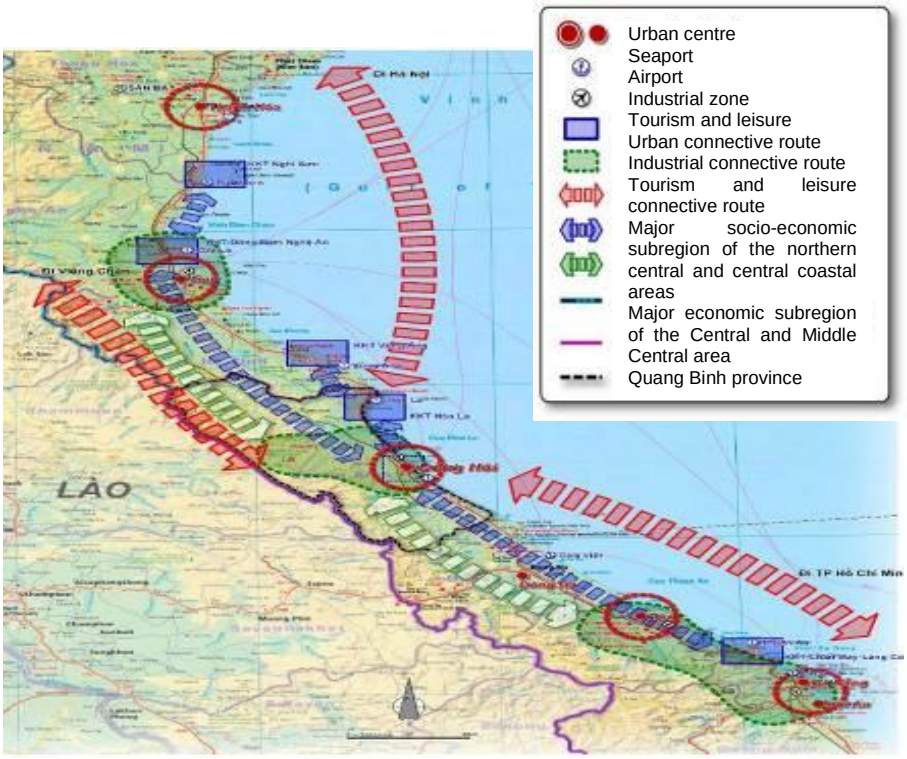


Figure2.7: Transportation Network in Dong Hoi City

2.4.3. Water Supply

Currently, Phu Vinh and Hai Thanh Water Treatment Plants are supplying water to the city. Phu Vinh Water Treatment Plant has a designed capacity of 19,000m^3/day, taking water from Phu Vung Reservoir, which has a capacity of 23,000,000 m^3. Hai Thanh Water Treatment Plant takes water from Bau Tro Reservoir and operates only five hours per day in dry seasons because the reservoir is salinized as being adjacent to the sea. The actual operating capacity of the plant is 3,000m^3/day while the designed capacity is 9,000m^3/day. In addition, water is supplied by Quan Hau Water Treatment Plant through a transmission system along the old Highway 1A. The designed capacity of this Plant is 1,000m^3/day.

Currently, 121.1 liter of treated water is supplied for each person per day in the inner city area; water supply coverage rate in the inner city is 97.36%; and the non-revenue water rate is 16%.

2.4.4. Drainage and Wastewater Treatment

Most of households in the inner city have septic tanks toilets, including 40 - 50% of the septic tanks connected to sewers, 30 - 40% infiltrating through pits or ditches in their houses or the pavements in front of their houses, the rest have “closed” septic tanks or does not have septic tanks at all.

Social survey shows that 52.1% of the surveyed households has wastewater from their toilets go to infiltration tanks or septic tanks. However, that rate is only at 37.3% low income area, at 53.2% in the roads built in the last 5-10 years, and at 59.3% in the inner city roads with better off people.

Table 2.19: Existing Toilet Wastewater Discharge Practices

Drainage location	Percentage
Drain to septic tank, and then to infiltration tank	52.1
Drain to septic tank, and then to external sewer system	18.3
Drain to biogas, and then to external sewage system	1.8

Drain directly to external sewage system	8.2
Drain to separate pit in garden	13.2
Drain to pond, lake, canal, ditch, river..	4.1
Other	2.3

Source: The CCESP - DH6.22

Dong Hoi city has both separate and common drainage systems.

(1) Stormwaterdrainage:

In general, there are 5 main drainage routes for Dong Hoi city including the Cau Rao river, the Le Ky river, Phong Thuy Canal, the My Cuong river, and Khe Duyen Reservoir Channel.

The CCESP in Dong Hoi constructed or upgraded 9,526 m of combined sewers, 13,056 m sewers, and 5,101m tertiary sewers. Together with the works financed by some other projects, Dong Hoi currently has 98.2 km of stormwater and combined drainage pipes. The drainage systems have been basically completed for Dong My, Hai Dinh, Dong Phu wards, parts of Bac Ly and Nam Ly wards.

Loc Ninh, Dong Son, Nghia Ninh, Phu Hai, the west of Huu Nghi Road and a large part of Bac Ly and Nam Ly areas are still subjected to flooding during or after heavy rains as drainage for this area was proposed in the CCESP but not implemented due to shortage of fund.

(2) Sewers:

The sewer system includes primary sewers (R1) collecting wastewater from the pumping stations to the wastewater treatment plant, secondary sewers (R2) conveying wastewater from streets to the pumping stations, and tertiary sewers (R3) collecting wastewater from sub-areas (R3) as represented on the diagram:

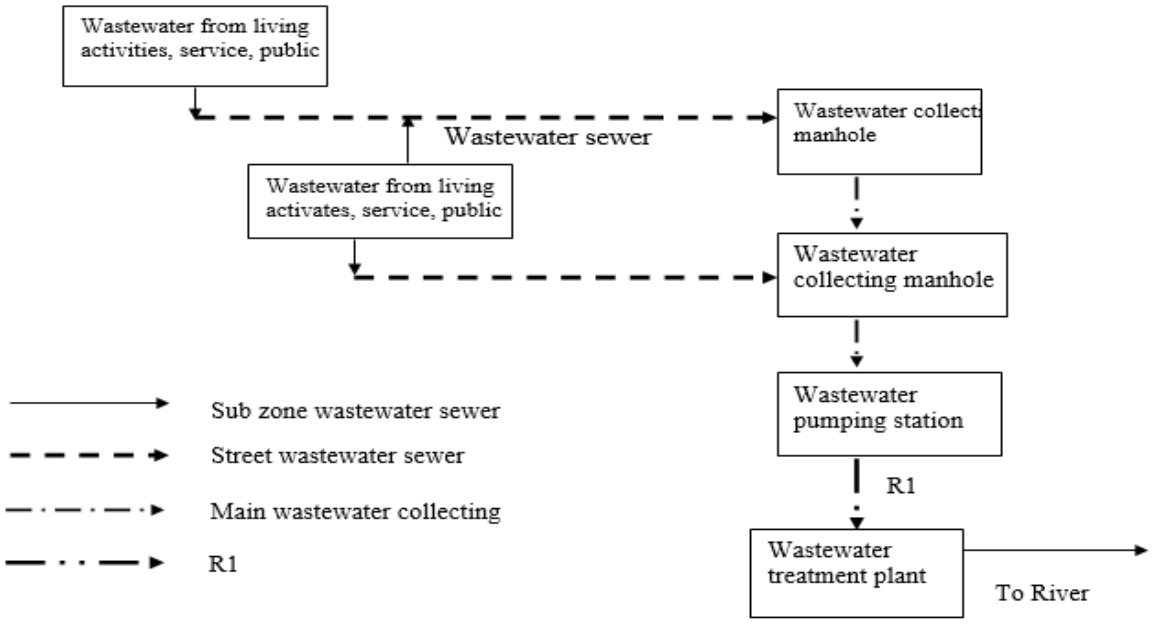


Figure 2.8: Diagram of Sewerage Network in Dong Hoi City

28.3km of main sewers were built under the CCESP to collect wastewater at Dong My, Hai Dinh, Dong Phu wards and parts of Hai Thanh, Bac Ly and Nam Ly wards. However, the current network covers only 40% of Dong Hoi city. At My Dinh and Hai Dinh wards, wastewater is collected and gathered by combined sewers, and then separated in Combined Sewer Overflows (CSO) then conveyed to treatment plant. Wastewater in the remaining areas is collected by separate sewers.

- All wastewater in Zone I including inner wards of Dong My, Hai Dinh and Dong Phu is conveyed to the pumping station and then to the wastewater treatment plant.
- The sewers in Zone II including the west of the railway in Nam Ly and Bac Ly ward can only cover nearly 20%.
- Zone III includes the east of the railway in Nam Ly and Bac Ly ward, only has a main sewer and a part of tertiary sewer.
- Wastewater of the entire Zone IV including Duc Ninh Dong ward, where the residential area is developed, is collected to the WWTP.
- Zone V including Hai Thanh ward collects only 55% of the wastewater in the whole area.

(3) Tertiary sewers connected to household toilets:

Currently, the city has more than 45.9 km of tertiary sewers constructed under the CCESP and some other projects: 5,374m covering 95% Dong My and Hai Dinh wards; 5.1km covering 70% Hai Thanh ward; 8km covering 70% of Dong Phu ward; the coverage is only nearly 20% for Nam Ly and Duc Ninh Dong ward.

About 30% area of Dong Hoi city (mainly in Bac Ly, Nam Ly, Duc Ninh Dong, Hai Thanh wards) does not have a wastewater collection system, and domestic wastewater in this area currently being discharged pours directly into the surrounding environment or infiltrates into the soil causing soil contamination and pollution in residential area.

(4) Duc Ninh Wastewater Treatment Plant – Dong Hoi city

Duc Ninh WWTP was built under CCESP. The plant has a designed capacity of 10,000 m^3/day-night by 2020. The construction was completed and put in operation since 2014. However, the treatment capacity of the plant just reaches only 6,200 m^3/day-night due to the incomplete wastewater collection system.

The Le Ky river receives the treated wastewater from Duc Ninh WWTP at the area of Duc Thuy, village, Duc Ninh commune, Dong Hoi city. The discharge point of the plant is 3.5m downstream from the confluence of the Le Ky and the Nhat Le rivers towards . The coordinates of the discharge point following VN 2000, projection 3^0, meridian 106^0:

X(m) = 1.927.506 Y(m) = 565.893

The treatment technology of Duc Ninh WWTP is described in Figure 2.7 below:

After one year of operation, Duc Ninh WWTP has contributed significantly to improve the environment of Dong Hoi city. Wastewater has been collected and treated as per the design, the treated effluent has been monitored regularly with treated wastewater quality data presented in Table 2.9. Pollution control and environmental mitigation measures have been implemented adequately during the operation phase. The gas emitted from the intake and biological ponds are collected and treated in chambers. Sludge has been circulated and reused for wastewater treatment in order to reduce waste generation.

- The WWTP has a built biological pond system, where the depth of water column is 1.5m and the thickness of the sludge layer is 0.5m. Water hyacinth and pennyworth are planted in the ponds as a secondary treatment before wastewater is led to the river.
- Fishes like carfs are raised in the facultative ponds and otherponds as biological indicatiions and to kill algae in the ponds. There are water intakes for aquaculture ponds within 1km from the WWTP's discharge point in the Le Ky river. There are also small scale fishing activities in this river section. These proves that the water quality in Le Ky River is quite good and the impacts on ecosystems are neligible. .

- Sludge generated from facultative ponds will pumped into solar dryingbed, then and used as fertilizer.

The WWTP has good landscape with many green trees, clean and there is no bad smell.

Trees planted around facultative lagoon

… and around aerobic treatment lagoon

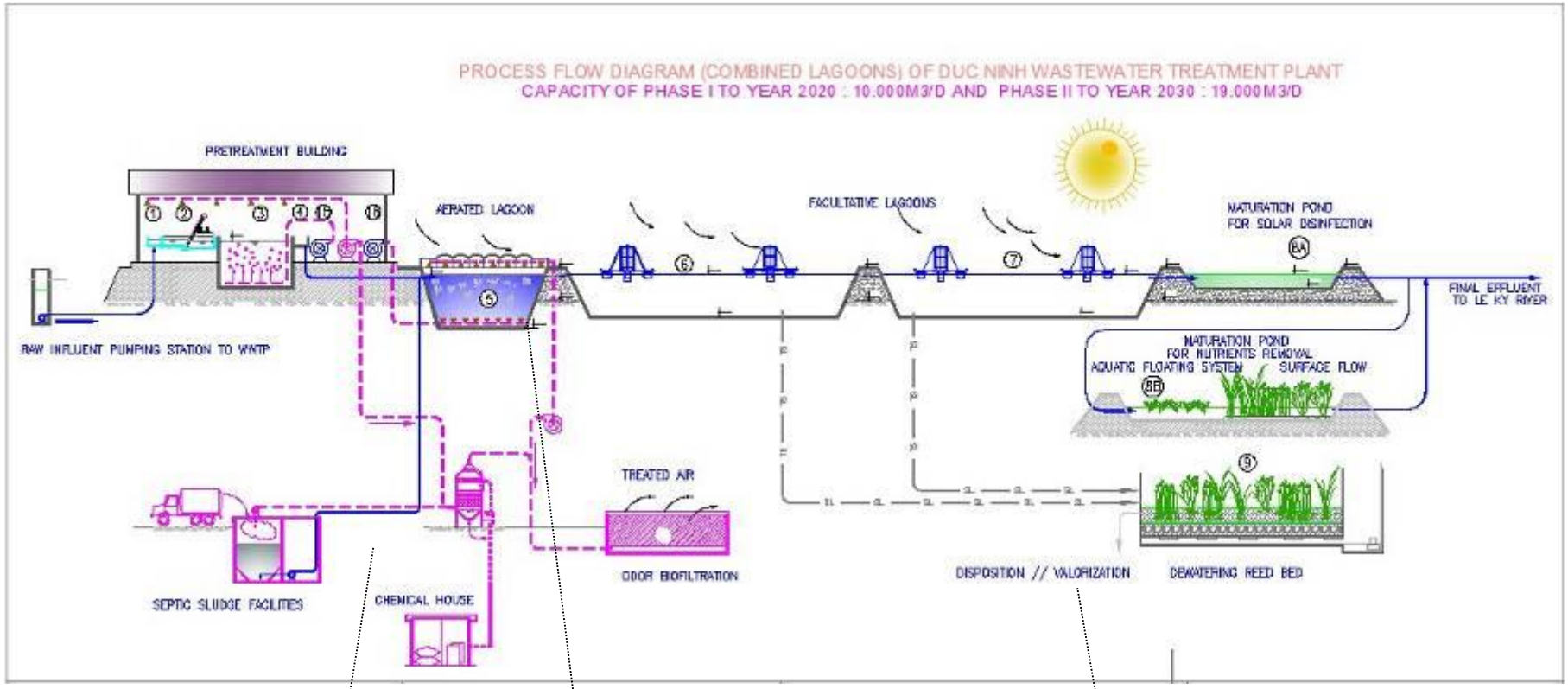
Birds observed in a tree

Vehicle parking area

Road, tree fence isolating the plant with surrounding areas

Sludge storage area with roof, surrounding wall and grass to mitigate pollution

Figure 2.9: Duc Ninh WWTP



Odor treatment:

α *Septic sludge facilities*

Pretreatment of raw wastewater (pump, rubbish screening and sandy settlement)

Smell disposal and biological purification

Wastewater treatment process:

α *Aerated lagoon*

α *Facultative lagoons,*

α *Maturation ponds (solar disinfection and nutrient removal of N&P).*

Sludge management :

α *Regular collection*

α *Sludge dewatering*

α *Sludge removal*

Figure 2.10: Diagram of Duc Ninh WWTP - Dong Hoi City

Wastewater has bad smell due to NH_3, H_2S and Mercaptan (a mix of organic Sulfo). Odour levels depend on various factors and the remaining wastewater in sewers. Odour will be emitted first at the intake wastewater pumping station, then at waste screens and sand sedimentation tanks at the pre-treated facilities. An aerated sand sedimentation tank will be designed for multi-purposes: degreasing, sand sedimentation, and odour collection. Polluted air and odour will be aerated and treated with oxidizing chlorine tower and biological filtration (being absorbed in $Ca(OH)_2$). The remaining NH_3 and H_2S (including mercaptan) will be absorbed by micro-organism of aerated ponds.

The WWTP operator, the Quang Binh Environmental and Urban Company Co. Ltd. has been undertataking proper environmental monitoring programs. The quality of wastewater after treatment has been tested daily in laboratory of the plant. The provincial Environment Monitoring and Engineering Center has been contracted to do sampling and testing environmental quality. In addition, the operator also organizes communication activities targeting at local people with the aims of raising environmental awareness .

2.4.5. Solid Waste Collection

In the city, solid wastes are generated from over 23,000 Households, 8 major markets, 7 small markets, 318 units of administrative units, and more than 2,000 business, tourism entity, restaurants, hotels. Currently, it is estimated that about 110 tonnes of solid wastes are generated each day but only 80 tonnes has been collected. Therefore, provisions of supplement garbage collection equipment has been proposed under CCSEP.

Solid waste management in Dong Hoi city has been responsible for by the by Quang Binh Urban Development and Environment One Member Limited Company (URENCO). The company has 8 garbage trucks, from 4.5 - 6 tonnes each, 512 garbage hand-push carts, and 487 garbage bins for garbage collection in the entire city. 16/16 wards/communes of Dong Hoi city has access to solid waste collection service with 20,607 households has domestic waste collection contracts. The collection rates in some communes and wards are still low, under 70%, including Bao Ninh, Nghia Ninh and Dong Son.

The Ly Trach landfill rehabilitated under the CCESP.

Gargage Truck of URENCO **Solid Waste Transfer station Weighting Station**

Ly Trach Landfill Site before and after the CCESP

Figure 2.11: Solid Waste Collection

The main road is swept manually and garbage is scooped to garbage handpush carts, then to

garbage compactors, and then transported directly into landfill. There are two teams with 128 workers to collect garbage. Currently, the landfill has been to be filled up quickly (the design capacity of 110 tonnes per day in 30 years lifecycle). Only 10% of the garbage has been classified or recycled.

There are five workers working at the landfill including one leader, one weighting station worker, one worker responsible for chemical spraying, one bulldozer driver and one guard. The workers are provided sufficient protective equipment and have periodical health check (one per year). URENCO strictly obeys operation manuals when operating the landfill site, mobilizes sufficient resources for proper operation.

Domestic wastes are often contained in household's bins. Some Households started to practice waste classification from source, making full use of organic wastes such as fruit skin, unused vegetable for their gardens. URENCO arranges garbage handpush carts to collect garbage at fixed locations and times everday. However, some garbage have been still being placed at road side, causing environmental pollution. In order to address the issue, URENCO proposed the provision of 1,000 garbagebins and the CCESP funded 500 bins. Additional 500 bins were proposed under the CCSEP.

Hazardous wastes has been collected and treated by specialised units of the adjacent provinces such as LILAMA Company (licensed by the Directorate of Environment to operate in hazardous waste management, Dung Quat- Quang Ngai Economic Zone Office).

2.4.6. Public Toilet Operation and Management

The CCESP invested in 04 mobile toilets at Nhat Le and Bao Ninh beaches, these toilets have been being well-managed the Dong Hoi Beach Management Board .The public toilets are provide free access to the residents and tourists.

2.4.7. Power Supply and Telecommunication

The power supply source of Dong Hoi city mainly comes from the national power network via high voltage lines and 110KV transformer substation. The power for 100% of the Households in the city is supplied by the national power network. The city is conducting cable bunching and undergrounding tens of km of power lines at the residential and urban areas, and the significant locations in the city. Post and telecommunication are highly developed in the city with better and better serving quality. ADSL, digital TV and internet services have been increased many times compared to 2015 to ensure the communication demand of local people.

2.5. CULTURAL, HISTORIC AND RELIGIOUS SITES

The important historic sites in Dong Hoi are Quang Binh Gate, Dong Hoi Wall and Moat, Thay Rampart, and vestiges of the wars in Tam Toa Church. The construction sites of the project's components as well as the project transportation activities will not affect those historic sites.

Dai Giac Pagoda is the religious structure closest to the construction site. The pagoda is about 200m southwest of Cau Rao River dredging area. Besides, the new Tam Toa Parish area is located on the Thong Nhat road, one ofthe transportation roads of the project. These two religious areas have important roles in the spiritual life and belief of the people in Dong Hoi city in particular, and people in other areas of Quang Binh province in general.

The martyrs' cemetery of Phu Hai Ward is located at 200m from the alignment of the proposed road starting from Nhat Le II Bridge.

Table 2.20: Cultural, Historical and Religious Sites in the Project Area

Photo	Description of the PCRs
 	The Giac Pagoda is located at Thong Nhat road and Duc Ninh Dong road. The pagoda is about 450m southwest of Cong Muoi bridge, faces Cau Rao River dredging area The original buddish pagoda was built long time ago but demolished by the war. The new pagoda was rebuilt in 2010 and upgraded in 2015. The pagoda has a total land area of 8,000 m^2, being run by the monks and under the management of Vietnamese Buddhist Association. The pagoda is aso the head quarter of the provincial buddishm association. The pagoda is a Buddhist learning center, and people visit here to find inner peace and serenity. People often come to the pagoda for visit, worship or pray on holidays, Tet (lunar new year), and full moon. There are 50 visitors per day on average. There are thousands of visitors to the pagoda from 1st to the 15th lunar January annually. There are also more visitors on buddish festivals on the 15th April lunar moth, tet festivals, the 1st and 15 th of lunar month
	The cemetery is located in Phu Hai ward. There is an existing road in the South of the cemetery's, being accessed by aquaculture farmers. This road will be used as construction access road The cemetery is the rest place of the war heroes and martyrs. Local people visit this place frequently, particularly on the 1st and 15 th of lunar month, 27th July calendar day to show their gratitude towards the martyrs. There are graves 56 in the cemetery.
	The parish was established in 2007, located at Thong Nhat road, Nam Ly ward. The parish is managed by Tam Toa Parish, Vinh city. Tam Toa parish, the church is located on Nguyen Du, Dong Hoi city today, was established around 1631 under the name "East Sea Parish, also known as They Luy. Tam Toa church was first built in 1887 and 1940, was rebuilt spacious and more complete. In 1968, the Tam Toa church was bombed. The first stone for construction of the parish church was laid on 21 April 2016. The parish is the meeting venue of Tam Toa parishioners to celebrate their spiritual life, wordship the God and Saints, and pray for their beloved people every Saturday and Sunday and other religious holidays such as Christmas days in late December calendar day.

2.6. SITE-SPECIFIC FEATURES AT SOME LOCATIONS

2.6.1. Along Drainage and Sewer Alignments

Site-specific features of some locations along drainage and sewer alignments are briefly described in the table below:

Table 2.21: Status of the Roads and Sensitive Sites

No.	Road	Existing Status	Proposed Construction	Photo of current status / sensitive receptors
1	Ly Thai To Road	- 12m-wide asphalt road without pavement, trees along the road sides are small and sparsely distributed; - Water and power supply systems run along the road, no existing drainage or sewerage systems; - The road sides are densely populated with houses, shops, restaurants, etc. - Dong Son Primary School No.1, Con Market etc. are located on road sides	Sewer routes Nos. 1, 2, 3, 5, 6: D200, L=1,971m, D300 L=1,027 m, D400, L= 671m; Drainage routes Nos. 1, 3, 3^{A}, 4, 5: D600, L=149m, D800, L=123m, D1000, L=1626 m, D1500 L=249m	 **Ly Thai To Road**  **Dong Son Primary School**
2	Le Hong Phong Road	- 9m-wide asphalt road without pavement; - Water and power supply systems run along the road; - There are no existing drainage or sewerage systems; - The road sides are sparsely populated and there are some small shophouses; - Sensitive receptor: Dong Son Secondary No.1	Drainage route No.1: D1500, L= 275m Drainage route No. 2: D600, L= 97m Drainage route No. 1: D400, L= 1898m	 **Le Hong Phong Road**  **Dong Son Secondary School No. 1**
3	Ton That Tung (Nam Ly) Road	- 8m-wide asphalt road without pavement; - Water and power supply systems run along the road; - Existing drainage and sewerage systems are incomplete – some sections do not have drains or sewers; - People live and do businesses (food and grocery shops) along the road; - Vietnam Cuba - Dong Hoi Hospital and Nam Ly Secondary School No.2 locate in this area.	Drainage route No. 9: D300, L=208m; Drainage route No. 6: D600, L=120m, D800, L=125m	 **Ton That Tung Road**  **Cu Ba-Dong Hoi Hospital**

No.	Road	Existing Status	Proposed Construction	Photo of current status / sensitive receptors
4	Trung Truong Road	- 6m-wide asphalt road without pavement; - A power supply system runs along the road; - There are no existing drainage or sewerage systems; - There are no residents and no sensitive receptors along the road.	Drainage route No. 6: D1.000, L= 147m, D1500, L=157m	
5	Ngo Gia Tu Road	- 6m-wide asphalt road with 2m-wide tiled pavements and many trees; - The power supply and drainage systems are completed, there is no sewerage system. - The area is densely populated, there are no offices, shops, and sensitive receptors.	Drainage route No. 7: D800, L=88m	
6	Huu Nghi Road	- 20m-wide asphalt road with road divider and pavement; - The water supply, power supply, and drainage systems run along the road. The sewerage system is incompleted; - People live along the road with many shops. The offices of Environment and Resources Department and Fire Fighter Police, hospital, etc. locate in along this road	Drainage route No. 8: D800, L= 132m Drainage route No. 14: D1000, L= 562m	 **Friendship General Hospital**
7	To Huu Road	- 12m-wide asphalt road with pavement; - A power supply system runs along the road; - The drainage and sewerage systems are incompleted; - The area is densly populated with many food and grocery shops. Nam Ly bus station locates at one road end.	Drainage route No. 9: D800, L= 397m	 **Nam Ly Coach Station**
8	Nguyen Van Linh Road	- 12m-wide asphalt road with one 3m-wide pavement completed for one road side; - A power supply system runs along the road; - The drainage and sewerage systems are incompleted. - The area is sparsely populated with no shops.	Drainage route No. 10: Box culvert 2x2m, L=188m	

No.	Road	Existing Status	Proposed Construction	Photo of current status / sensitive receptors
9	Le Truc Road	- 7m-wide asphalt road with pavement; - Water supply, drainage, and powr supply systems run along the road. There is no sewerage system; - The area is sparsely populated with some small shops by road sides; - Hoa Hong Kindergarten and some offices locate along the road.	Drainage route No 11: D800, L=132m	 **Hoa Hong Kindergarten**
10	Nguyen Huu Canh Road	- 15m-wide asphalt road with road divider and pavement; - Water supply, drainage, and powr supply systems run along the road. There is no sewerage system; - The area is sparsely populated with some small shops by road sides.	Drainage route No. 12: D800, L=160m	
11	Sub-area 4, Dong Phu	The drainage route No. 13 in sub-area 4, Dong Phuc ward is currently a soil canal covered with grass.	Drainage route No. 13: D1500, L=268m	
12	Alley of Thong Nhat Road (Duc Ninh Dong)	- A 6m-wide road that is under construction with box culverts (80x80) for drainage and sidewalk purposes; - The water and power supply systems are adequate; - This area is sparsely populated with no business activities; - There are no sensitive receptors.	Drainage route No. 15, D600, L=226m	
13	Phan Dinh Phung Road	- A 12m-wide road with 3m-wide uncompleted pavement; - There are no drainage and sewerage systems; - People live along the road sides with many shops;	Drainage routes No. 16, 17, 18, 22 and 23: D800, L=134m, D1000, L=1,381 m, D1500, L=675m.	 **Phan Dinh Phung Road**

No.	Road	Existing Status	Proposed Construction	Photo of current status / sensitive receptors
		- Bac Ly Secondary School No.1 and Bac Ly Primary School No.1, etc. locate in this road		 **Bac Ly Secondary School No.2**
14	Hoang Dieu (Nam Ly) Road	- A 8m-wide asphalt road with no pavements; - The water and power supply systems run along the road; - The road sides are densely populated with many shops.	Drainage route No. 19: D800, L=299m; D1000, L=77m Drainage route No. 20: D800, L=288m	
15	Le Loi Road	- A 20m-wide asphalt road with 2m-wide pavement for the section from Quang Binh Gate to Thong Nhat Road only; - The power supply system runs along the road; the drainage and sewerage systems are incompleted; - The road sides are densely populated with lots of business operation; - Dong Hoi General Hospital and Dai Giac Pagoda locate on the road.	Drainage route No. 21^{A}: D600, L=340m; D800, L=99m;	 **Le Loi Road**  **Dong Hoi General Hospital**  **Dai Giac Pagoda**
16	Road TK9, Bac Ly	- A 6m-wide asphalt road without pavement. The trees along the road sides are small and sparse; - The power supply system runs along the road;	Drainage route No. 24: D1000, L= 453m D1500, L= 436m Sewer route	 **Road TK9, Bac Ly**

No.	Road	Existing Status	Proposed Construction	Photo of current status / sensitive receptors
		- People living along the road sides are mainly small traders; - Central Culture House of sub-zone No. 9 locate in the area.	No. 14: D300, L= 475m	 **Culture Center of sub-zone 9**
17	Phan Huy Ich Road	- A 4m-wide asphalt road without pavement; - Water and power supply systems are adequate; - Drainage and sewerage systems are incompleted; - The area is sparsely populated with limited business activities; - There are no sensitive receptors along this road.	Sewer route No. 4: D300, L= 520m	
18	Tran Nhat Duat Road	- A 9m-wide asphalt road without pavement; - Water and power supply systems are adequate; - Drainage and sewerage systems are incompleted; - The area is sparsely populated with limited business activities; - There are no sensitive receptors along this road.	Sewer route No. 7: D300, L= 628m	
19	Nguyen Van Troi Road	- A 9m-wide asphalt road with 3m-wide pavements. - The power supply system runs along the road; - There is no drainage system in this aree; - The population is sparse, mainly located by some offices and storage areas. There are no sensitive receptors in the area.	Sewer route no. 8: D300, L=400m	
20	Bau Tro Reservoir (Hai Thanh Ward)	- A 6-meter wide concrete road heading to Bau Tro Reservoir; - Stormwater drains and sewers are not available; - The power supply system runs along the road;	Sewer route No. 11: D300, L= 316m	 **Road to Bau Tro Reservoir**

No.	Road	Existing Status	Proposed Construction	Photo of current status / sensitive receptors
		- There are many trees around Bau Tro Reservoir yet no households.		 **Bau Tro Reservoir**
21	Truong Phap Road	- A 15m-wide asphalt road with road divider and pavements; - The water supply and drainage systems run along the road. The sewerage system is not yet available; - There are many restaurants and hotels, especially in the East where Nhat Le beach is close by (the peak time is from March to August); - Wastewater generated from the restaurants and hotels is preliminarily treated and dishcharged to R3 canals or absorbed by natural soil.	Sewer route No. 12: D150, L= 499m	 **Truong Phap Road**  **Restaurants and hotels on the road**  **Nhat Le Beach**
22	Hoang Sam Road	- 7m-wide asphalt road without pavements; - The area is densely populated yet there are no offices and shops; - There are no sensitive receptors in this area.	Sewer routes Nos. 13, 15, 23 and 24: D150, L=432m; D200, L=346m D300, L=596m D400, L=229m	
23	Extended Dang Thai Than Road	- A 4m-wide asphalt road without pavements yet with lots of trees; - The power supply system runs along the road; - The area is sparsely populated with no business activities; - There are no sensitive receptors in this area.	Sewer routes No. 16: D300, L= 558m Sewer route No.17: D300, L= 219m	

No.	Road	Existing Status	Proposed Construction	Photo of current status / sensitive receptors
24	Vu Trong Phung Road	- A 6m-wide asphalt road without pavements; - The power supply system runs along the road; - People living along the road sides are mainly small traders; - There are no sensitive receptors in this area.	Sewer route No. 20: D300, L= 334m	
25	Le Duc Tri Road	- A 6m-wide asphalt road with 2m-wide pavements. The trees on the pavements are small and sparse; - The power supply system runs along the road. Drainage and sewerage systems are not yet available; - People reside along the road with limited business activities; - There are no sensitive receptors in this area	Sewer routes Nos. 25, 26 and 27: D300, L = 1,358m	

2.6.2. Outfall Areas

D1500 outfalls, connected to the drainage system, will be designed and constructed at the bank so as rainwater can be discharged into some lakes and rivers as described in Table 2.22:

Table 2.22: Existing Status of the Lakes

No	Outfall	Status of reservoirs	Photo
1	CX1, CX2	Dong Son Lake Area: 2.52ha; capacity 25,200m^3; Basin area: 32.7ha; Connected with My Cuong river through 0.6m x 0.6m box culverts and an irrigation canal The existing water level is +3.20m, and the depth is about 1.50m. Shrubs are growing around the reservoir. There are no residents in the area.	 ***The reservoir's status***  ***Sluice gate to My Cuong River***

No	Outfall	Status of reservoirs	Photo
2	CX3, CX5	Tay Huu Nghi Reservoir Area: 0.89ha; storage capacity 10,680 m^3; basin area: 64.65 ha; connected to Cau Rao river with 2m x 1.5m x 1.5m reinforced concrete culvert. Currently, this is is an abandoned low land with the average bottom level of about +1.20m. The lowest level of surrounding roads is +3.20m. Shrubs are growing around the reservoir. There are no residents in this area.	 *The reservoir's status*  *Open discharge canal to Cau Rao River*
3	CX4, CX6	Khe Duyen lake Area: 24.72 ha, storage capacity: 370,800 m^3; basin area: 180.25 ha; connected to Le Ky river through a 5mx1.75m drainage ditch. Currently, the lake is a low land area, steeping towards the downstream. The reservoir level is about 2.00m lower than that of the surrounding roads. Shrubs are growing around the reservoir. There are no residents in this area.	 *Khe Duyen lake*  *Discharge direction to Le Ky River*

2.6.3. Pumping Stations

Each pumping station has a chamber with dimentions a x b = 2.5 x 2.5m 3.5 x3.5m; at 6.5m-8m deep underground. 2-3 automated pumps will be installed at each station and operated alternatively to reduce starting times of each pump. Booster pumping stations have overflow pipes for emergency cases. Coarse filter is installed at the pumping station to retain big size garbage and waste. Concrete structures are made of materials resistant to corrosion by wastewater. The existing status of pumping stations are described in the below table:

Table 2.23: Construction Areas of Pumping Stations

No.	Pumping station	Status	Photo
1	PS No. 15	- There is an existing two-laned, 12-14m wide asphalt road; - The are is densely populated with many shops and offices; - There is an existing drainage system along the road. All households have septic tank toilets for treatment of domestic wastewater.	
2	PS No. 16	Currently, this is a vacant land which is 4m far from the pavement of Ly Thai To road, locating in Residential Area No. 2, Bac Nghia ward, and being managed by the Ward People's Committee	
3	PS No. 17	The area is filled with 1m-high spoils and separated with the nearest household by a 4m-wide concrete road in the East. It borders with a 4m-wide asphalt road in the South.	
4	PS No. 18	The site is a flat land, separated with the nearest household by a 4m-wide concrete road in the West. It borders with a 12-14m wide asphalt road in the South.	
5	PS No. 19	The land is unused, there are no residents around.	

2.6.4. Cau Rao River and Cong Muoi Bridge

The man-made Cau Rao river is 4.5 km long. Among that, 3.6 km from source and and 0.5 km from the river mouth were dredged and the embankments were lined, with 10.5m-wide access roads along the river banks were built. Only the middle section (475m long) of the river has not been dredged and the embankment has not been lined. The average width of the river is 50m. There is an existing sluice gate for salinity intrution prevention at the upstream of the dredging section. The gate is closed in dry season.

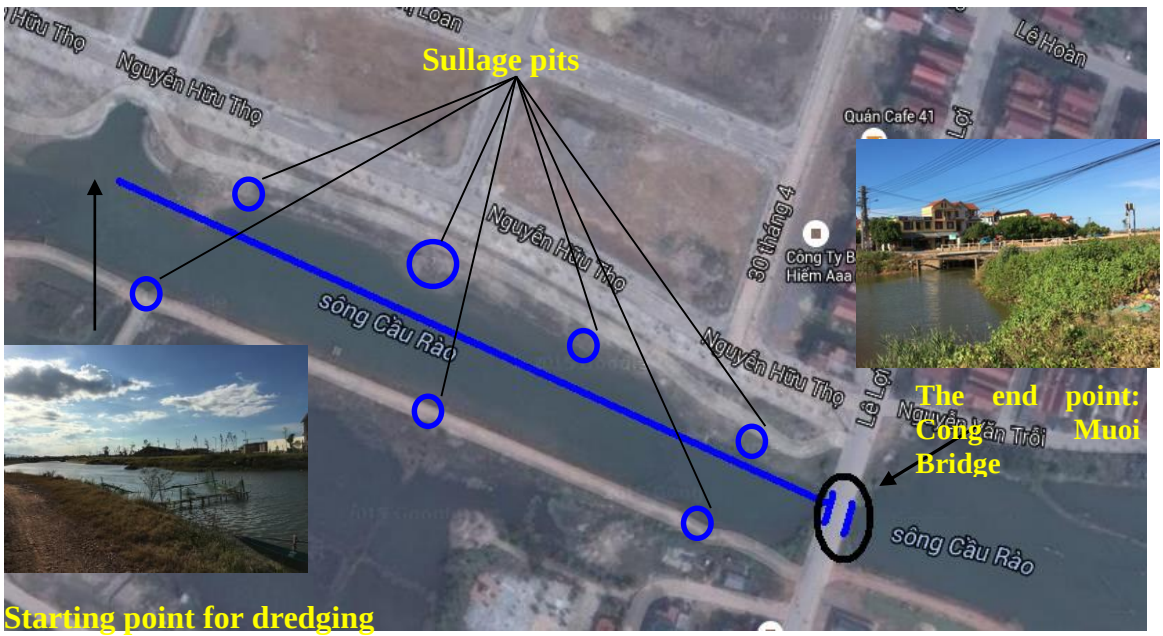
At the present, flood discharge capacity of Cau Rao River has been limited by the narrowed cross section at the Cong Muoi Bridge, which is only 11 m. In rainy seasons, localised flooding

has happened at the riverside roads and the Ly Loc rice field upstream.

Currently, the water flow in the dredged area is smooth, the scenery on the river banks is nice and water quality is good. Regular environment monitoring reports of the CCSEP in 2014 show that the surface water samples taken from Cong Muoi on Cau Rao river had SS, DO, COD, BOD5, T-P, T-N, and Coliform within allowable levels according to Vietnamese Standards QCVN 08:2008 – B1 (National technical regulation on surface water quality). Field surveys noted that there are small-scale fishing activities in the river. According to the analysis results of aquatic samples taken from Cau Rao river and the Biologic Diversity Report by Quang Binh provincial Department of Sciencies and Technology[8], the main caths are mainly brackish water species, shrimps and crabs in Cau Rao River and there are no precious water species.

The Cau Rao river segment to be dredged in the CCSEP starts from the river's T-junction on Nguyet Huu Tho Road and ends at Cong Muoi Bridge with a length of 475m. The river segment has earthern banks with grass and bushes and almost no residents living in this area. The dreging area is 250m far from the nearest house and 200m far from Dai Giac Pagoda which locates at the West bank of Cau Rao river. There are total seven surface water outfalls along this river segment, including three outfalls on the West (two D500, and one D1000) and four outfalls (including one sluice gate and three D1000 outfalls) in the East (Nguyen Huu Tho Road).

The Cau Rao River segment to be dredged is described in Figure 2.12 below:



[8] *https://skhcn.quangbinh.gov.vn/3cms/upload/khcn/File/SachKhoaHoc/410.../3.doc*

Sewer from Dai Giac Pagoda

Fishing in Cau Rao River

Figure 2.12: The Dredging Area at Cau Rao River

❖ Cong Muoi Bridge construction area

View from upstream to Cong Muoi Bridge

Cong Muoi Bridge

Existing pipes parallel with the bridge

The bridge's access on Le Loi Road

Figure 2.13 Cong Muoi Bridge

Cong Muoi Bridge is on Le Loi Road. Currently, Cong Muoi Bridge has one span, is 20m wide, 15m long, and 2m high clearance. The bridge surface is at the same level with Le Loi road, thus, no slope. The access road to Dai Giac Pagoda (400m from the bridge) is on the left of the bridge. On the Dai Giac Pagoda side, power supply lines are installed above and along the bridge, and a water supply pipe runs in parallel at the 1m-far distance. Cong Muoi petrol station is close to the crossroad which is 150m from the bridge.

There are no restaurants or business bases at two bridge ends. Local people with permanent houses reside along Le Loi Road, 200m far from Cong Muoi bridge. Traffic density on Le Loi Road and Cong Muoi Bridge is around 1,052 cars per day and 182 motorbikes per day. There is a bridge on Road 28/3 which is parallel to and 600m from Cong Muoi bridge. Cong Muoi

and 23/8 bridges are connected by Nguyen Huu Tho Road on the east bank and Thong Nhat Road on the west bank as shown in Figure 2.14. Because Cau Rao river serves drainage purpose for the city, there is no waterway transportation.

Figure 2.14: Transportation at the Dredging and Embankment Lining Area and Cong Muoi Bridge

Figure 2.14 shows that ahead of the dredging section, towards the river upstream, there is a small intake canal the balancing lake of the new urban area by Nguyen Huu Tho road. The lake links to Cau Rao river via a small canal of about 50 m long and 20 m wide.

The locations planned for workers' camps and temporary material yards during dredging and embankment lining of Cau Rao river and construting Cong Muoi bridge are described as below:

A 1.2 ha vacant land that is 50m far from Cau Rao river will be used as a temporary parking are for construction plants, equipment, and a workers' camp during dredging and embankment lining of Cau Rao river

A 0.5 ha vacant land at one end of the existing Cong Muoi bridge, at the side of Nguyen Huu Tho road, will be used for a workers' camp and material yard during construction of Cong Muoi bridge

2.6.5 Toilet Sites

The status of the areas and schools where mobile/ public toilets will be installed/built are described in Tables 2.24 and 2.25.

Table 2.24: Mobile/ Public Toilet Sites

No	Location	Status	Photo
1	Khe Chuoi Beach	- Located on planned beach tourist site Khe Chuoi beach (plan approved by Quang Binh's People Committee at Decision No. 2238/QD-UBND dated 18/8/2014. The population here is sparse.	 **Sandhill, has not been developed**  **The beach area**
2	Hai Thanh Bridge	The toilet will be installed in the cornor between Hai Thanh Bridge and the park in Dong My ward (which locates on the bank of the Nhat Le River).	 **Hai Thanh Bridge overlooking to Nhat Le Bridge**

No	Location	Status	Photo
3	Coconut garden, opposite Quang Binh Lottery Company	The planned area for mobile public toilet locates on the pavement of Huong Giang road along the bank of Nhat Le river. Huong Giang Road starts from Dai Bridge to Dong Hoi Market. This is a special route because only one pavement on the bank of Nhat Le river is maintained (The pavement is red tiled with green grass sidewalks, flowers, and coconut trees for decoration). On the opposite site starting from Quang Binh Lottery Company to Dong Hoi Market, it is with small pavement or without pavement. Nhat Le River segment from Dai Bridge to Dong Hoi Market is the place for boats to anchor with 2 floating restaurants (Binh Yen and Song Thanh). There are no special cultural and architectural structures here.	 
4	Tam Toa Corner	The area locates inside Dong My Park.	
5	Con Market	The area locates on the South East corner of Con Market, near the side exit .	
6	Cong Doan Market	The empty ground locates at the corner of Cong Doan Market, near parking area.	

Existing conditions of proposed school toilet construction sites are described below:

Table 2.25: School Toilet Sites

TT	School	Status	Image
1	Dong Son Secondary School No. 1	- 507 students and 40 teachers. - The school currently has two toilets built in 2012: One 25m2 for the teachers, one 30m2 for the students. Both toilets has adequate water supply. The toilets are safe, convenient and clean. It is 5m from the nearest classroom to the students' toilet . Roof for access roads should be built. - Toilet cleaning is contracted to the school guards at cost of VND 800,000 per month paid by Parents Association. - It is proposed to demolish the existing toilet and build a new one at the same site.	
2	Bac Nghia Secondary School	- 425 students and 30 teachers; - At present, there are two toilets: a clean and fully-water-supply 25m^2 teacher toilet, and one 30m^2 degraded student toilet that has no cover, no water supply and is 35m far from classrooms. - It is proposed to build a new toilet at a more convenient location for students.	 **The toilet for students built in 2013** **The old and separated toilet for students. Built long time ago, degraded** 
3	Duc Ninh Dong Primary School	- 300 students and 25 teachers. - The school has two toilets: one 35m^2 teacher toilet built in 2011 and one 30m^2 student toilet built in 2012. Water supply for the toilets are sufficient but there are no roofs from classroom to the toilet. - Toilet cleaning cost is VND 1,000,000 per month, paid by the school budget. - It is proposed to build a new toilet at a more convenient location for students.	
4	Hai Thanh Secondary School	- 195 students and 25 teachers. - The school has two toilets: one 25m^2 teacher toilet and one 30m^2 student toilet, both were built in 2011. The toilets are provided with sufficient water but being degraded and some sanitary equipment is damaged. - Toilet cleaning cost is VND 1,000,000 per month, paid by the school budget.	

		- It is proposed to build a new toilet at a more convenient location for students.	
5	Loc Ninh Secondary School	- 416 students and 33 teachers. - The school has two toilets: one 20m^2 teacher toilet built in 2003 and one 15m^2 student toilet built in 1997. Both of the toilets are degraded, unclean, and not supplied with sufficient water. The toilets are 80m far from classrooms. - Toilet cleaning cost is VND 500,000 per month, paid by the school budget. - It is proposed to build a new toilet at a more convenient location for students.	
6	Quang Phu Secondary School	- 362 students and 33 teachers. - The school has two toilets: one 25m^2 teacher toilet built in 2015 and one 30m^2 student toilet built in 2012. The toilets are close to each other, at the back of the teachers' parking area, and supplied with adequate water. It is about 20m from the student toilet to classrooms. - It is proposed to build a new toilet at a more convenient location for students.	
7	Duc Ninh Secondary School	- 480 students and 43 teachers. - The school has one 40m^2 toilet for students built in 2011 that is 40m far from classrooms. The toilet is degraded without any roof from classrooms to the toilet. - It is proposed to build a new toilet at a more convenient location for students.	
8	Duc Ninh Primary School	- 721 students and 54 teachers - The school has one 45m^2 toilet for students built in 2010 that is 40m far from classrooms. - It is proposed to build a new toilet at a more convenient location for students.	

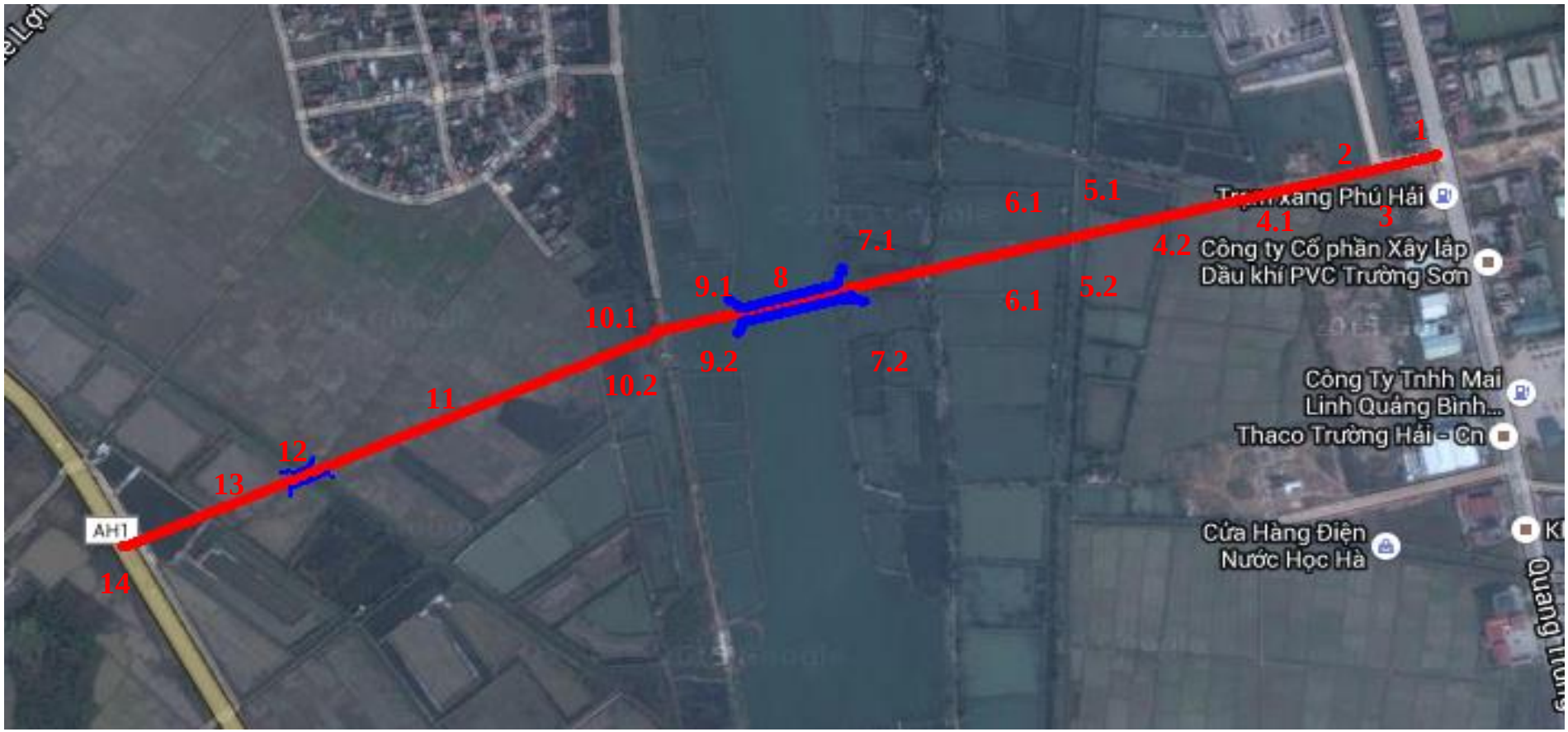
2.6.6. Proposed Road and Bridges

❖ ***Existing Activities on Le Ky River***

Le Ky River receives treated wastewater from the WWTP. Le Ky bridge will be constructed under the project. Le Ky River is 20m wide. Only small fishing boats travel on the river and there are no large boat/ships. Le Ky River supplies water to irrigate around 70 ha of rice field on the river's banks at Duc Ninh commune of Dong Hoi city, and Luong Ninh and Vinh Ninh communes of Quang Ninh district. The water intake is located 2-3 km upstream of Le Ky Bridge construction area.

Along Le Ky bridge construction area, there are aquaculture ponds (fishes and shrimp). Water in the ponds is taken from Le Ky river, and wastewater is also discharged to Le Ky River. There are no residents in this area.

❖ ***The construction areas of road and bridge are shown in Figure 2.15 below:***



Notes: Road

Bridge on the road

Figure 2.15: Description of the Road and Bridge

The existing features along the road alignment are described in the Table 2.26 below:

Table 2.26: Existing Conditions along the Proposed Road and Bridge

Km	Status description	Photo	
0	The beginning point is connected with Quang Trung Road and heading to Nhat Le II Bridge. The Petrol station on Quang Trung Road is located on the left of the alignment and is 50m from the road beginning point;	 The connection point with Nhat Le II Bridge	 The petrol station on the left of the planned road
50m	The road will pass Phu Hai ward's cemetery, the distance from the cemetery to the road is 50m Chu Văn An school is 200m from the road	 The concrete road to Chu Van An school	 In front of Phu Hai cemetery
60m	The centraline of the road is the area located behind the petrol station (opposite to the BT road leading to Chu Van An School). The area is currently abandoned ricefield under the management of Phu Hai ward. garbage and waste are dumped there.	 Rice field opposite to Phu Hai cemetery	 Road with cut through the abandoned ricefield
300m	*4.1.* The road cut through the ricefield at Phu Hai ward (opposite to Phu Hai cemetery). *4.2.* The road cut through feeder canal with cross section of 1,0m. There are casuarinas trees, 4-5m high, grown along the canal. Mimosa Pigra, an invasive plant species availabe in this area.	 Newly grown rice field in Phu Hai	 Irrigation canal next to the field

395m	*5.1.* The road cut through abandoned aquaculture pond in Phu Hai ward (the photo on the right), this section is83 m long (the pond edge is 395m far from Quang Trung road). *5.2.* The road cut through the main 20 m wide earthen irrigation canal.	 The road goes through abandoned pond	 Earthen irrigation canal route
500m	*6.1.* The road crosses the earthen irrigation feeder canal (take water from main canal to supply for the aquaculture ponds) with 2m in width. It is planned to build DN 150 reinforced concrete pipes; *6.2.* The road crosses the aquaculture ponds (rising crab, shrimp etc.) at Diem Hai village, Phu Hai ward. The ponds have the total length of 130m from the starting point to the embankment of Le Ky River.	 Earthen feeder canal	 Aquaculture pond at Diem Hai village
600m	*7.1.* This is the starting point of the access to Le Ky Bridge. The road cut cross Le Ky embankment. The embankmentis 25m wide and have been topped with stone on the river side. *7.2.* Under the embankment berms are uncontrolled aquaculture ponds on the river side, located within the irrigation work protection corridor. The ponds run along to the Le Ky river with the total length of 78m	 The Le Ky River's embankment (Phu Hai ward)	 Aquaculture pond outside Le Ky Embankment
700m	Le Ky Bridge, 212m long, 30m wide, 6 spans (7 piers), each span is 33m long, the bridge's width is 30m.	 Le Ky Bridge construction section	
800m	*9.1. The road cuts cross* aquaculture ponds outside the embankment of the Le Ky river. The ponds belong to the households in Diem Nam village, Duc Ninh Dong ward (The length of the ponds from the river-bed to the embankment is about 44m);	 Aquaculture pond at Diem Nam	 The embankment of the Le Ky River (Duc Ninh Dong)

900m	The road cross the abandoned lagoon which is the catchment that receives and store Cau Tay river water and then convey to Le Ky river.	 Abandoned pond at Duc Ninh Dong	 Abandoned pond at Duc Ninh Dong
1200 m	*11.1.* The road cuts through agriculture cultivation area (rice fields, alternative aquaculture ponds) under the management of Duc Ninh Dong Agriculture Cooperatives; *11.2.* Total length of the agriculture area (rice growing, fish raising etc.) toward West Bridge River is 281m (end of administration boundary of Duc Ninh Dong ward, border with Duc Ninh commune).	 Alternative of rice fields and aquaculture ponds	 Aquaculture pond next to West Bridge River
1300 m	The planned West Bridge with one span, 24m in length and 21m in width. Lots of mimosa pigra are found in this area.	 West Bridge River (Duc Ninh Dong)	 The farm in Duc Ninh Commune
1340 m	It is about 200m from Cau Tay to Dong Hoi City's bypass. The road crosses aquaculture ponds being leased in 50 years by 02 Households in Duc Ninh commune; and the 40 m long abandoned land area (with grass) being managed by Duc Ninh commune.	 Aquaculture pond at Duc Ninh Commune	 Combination of raising fish and duck
1440 m	As per the design, this will be a big intersection between the project road and the city bypass. The new road will end at the intersection with Dong Hoi city bypass with a total length of 1,438m. There are no residents in the bypass area except two farms in Duc Ninh commune.	 Grass area	 The road ends at the bypass

Workers' camps, and temporary yards for construction plants, equipment, and materials during construction of 1.44km road, Le Ky bridge, and Cau Tay bridge are planned to be built up at below sites:

The vacant land in front of Phu Hai cemetary, adjacent to one end of 1.44 km road. A worker's camp and a temporary material yard will be arranged here.

The vacant land by the dyke road at the construction site of Le Ky bridge will be used for a workers' camp and a material year during bridge construction.

CHAPTER 3: SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT

3.1. POSITIVE IMPACTS OF THE PROJECT

It is expected that upon completion, the Project will provide significant positive social and environmental impacts as discussed below:

- The extended sewerage collection system and the upgraded wastewater treatment plant will further improve environmental and sanitation conditions in the city, thus, enhancing living conditions of the urban population. Surface water and groundwater pollution problems related to untreated domestic wastewater will be addressed in targeted city areas and improve the urban environment. The extended drainage system will help to address localized flooding issues and local residents will no longer have to endure flood related traffic, health and safety risks:
- The provision of new solid waste collection equipment, school and public toilets will additionally contribute to improving sanitation conditions in the city, particularly in public and residential areas, schools and thus improve the health of the city population;
- The newly constructed road and bridges under Component 2 will facilitate the connection of the planned sewer pipelines in Bao Ninh peninsula (financed by the ADB) to the existing Duc Ninh WWTP for treatment. This will facilitate improving the environmental sanitation conditions in Bao Ninh peninsula. The new road and bridges will also help the people of the Bao Ninh peninsula to evacuate more quickly to higher locations on the mainland in increasingly frequent extreme weather events, particularly during floods;
- Dredging and embankment lining the remaining section of Cau Rao river will resolve completely localized flooding in the areas surrounding Cau Rao river, enhancing and improving the city's utility and landscape;

  After the Cong Muoi Bridge is expanded and the Cau Rao River is dredged, the 10 locations in the city currently subjected to frequent flooding with average inundation depth from 10cm to more than 40cm will benefit from the drainage thus provided. More than 400 households (HHs) and 60 business HHs will be no longer be affected by frequent localized flooding. Losses of 3.3% of households' average annual incomes or VND 5,000,000 per business HH per year would be reduced by 80% after this flooding issue is addressed;
- The project will produce job opportunities and additional income sources for local laborers during construction phase as the Contractors are required to employ local labor to carry out simple manual works.

3.2. CLASSIFICATION OF NEGATIVE IMPACTS

There will be potential negative risks and impacts during the pre-construction, construction, and operation phases. Through basic data analysis, field surveys, and consultation with relevant parties, the potential environmental and social negative impacts and risks of the project are identified and classified as below:

Significant Impacts (S)

- Impacts on large land areas, important areas, or changes in environmental conditions in a period of more than two years;
- Impacts exceeding permitted standards and regulations. Long-term and large-scale impacts;
- Changes in ecological systems, impacts on ecological systems of large areas, or medium impacts (lasting for more than two years) yet required recovery period of the affected ecological systems is ten years;
- Impacts on health of people;

- Economic losses and damages to the sub-project nearby people and communities;
- Potential significant social and environmental impacts which can only be controlled and mitigated if proper mitigation measures are implemented.

Medium Impacts (M)

- Impacts on large areas for a period from six months to two years;
- Changes in ecological systems or ecological functions at the localities in a short time and recovery capacity is good. The impact levels are similar to current changes yet such impacts can have a cumulative effect;
- Impacts might (or might not) affect people's health, causing impacts on persons in the surrounding areas;
- Impacts are medium, localized and temporary and mitigation measures should be carried out.

Low Impacts (L)

- Social and environmental impacts that cause significant changes in less than six months or medium changes for a period of less than two years;
- Impacts are within permitted standards and regulations, causing minor changes at present. Impacts are fully controlled;
- Impacts that might affect daily activities yet not cause any obstruction to communities;
- Insignificant impacts on health and living standards of people;
- Impacts are minor, localized, and can be neglected.

No Impacts (K)

- Impacts that are unrecognizable or cannot be identified yet such impacts can also be caused by daily activities;
- No social and environmental impacts.

Types and scope of negative impacts of the sub-project are identified by each work items and summarized in the Table 3.1:

Table 3.1: Social and Environmental Impacts of the Project

Impact	Physical environment			Ecological systems		Socio-environment				Others	Remarks
	Dust and noises	Soil and water	Solid waste/ sediment	Forests, natural reserve areas	Aquatic system	Land acquisition and resettlement	Local people	PCR	Livelihoods, social security, and land use	Flooding and traffic safety	
Construction of drains, sewers, manholes, and pumping stations (Component 1)											
Pre-construction	K	K	K	K	K	K	M	N	L	K	
Construction	M	N	S	K	K	M	M	N	M	M	
Operation	N	K	N	K	K	K	K	K	K	K	Most impacts are positive
Dredging and embankment lining of the Cau Rao river and Cong Muoi bridge (Component 1)											
Pre-construction	K	K	K	K	L	K	N	N	K	K	
Construction	M	M	S	K	M	N	N	N	N	M	
Operation	K	K	N	K	K	K	K	K	K	K	
Supply of equipment for Duc Ninh WWTP, capacity 14,000 $m^{3/}$ day and night (Component 1)											
Pre-construction	K	K	K	K	K	K	K	K	K	K	
Construction	N	N	N	K	K	K	K	K	K	N	
Operation	M	M	M	K	K	K	K	K	K	K	Most impacts are positive
Supply of equipment for the solid waste management system (Component 1)											
Pre-construction	K	K	K	K	K	K	K	K	K	K	
Construction	K	K	K	K	K	K	K	K	K	K	
Operation	M	M	M	L	K	K	N	N	N	N	Most impacts are positive
Construction of public toilets and school toilets (Component 1)											
Pre-construction	K	K	K	K	K	K	K	K	K	K	
Construction	M	M	M	K	K	K	K	K	L	L	
Operation	M	M	L	K	K	K	K	K	L	K	Most impacts are positive
Construction of roads, Le Ky and Tay bridges (Component 2)											
Pre-construction	N	N	N	K	K	S	S	M	S	K	
Construction	S	S	S	K	M	K	M	M	M	M	
Operation	S	L	L	K	L	K	K	K	K	K	Most impacts are positive

3.3. POTENTIAL NEGATIVE IMPACTS AND RISKS

3.3.1. Negative Impact Assessment for Component 1

Proposed Investments under Component 1 includes : (i) construction of 9.82km combined drains and sewers D600-1500 or BxH = 3000x1500 made of reinforced concrete, six stormwater outfalls made of reinforced concrete D1500, 14.07 km of sewers HDPE D150-500, 41.1 km of uPVC D300 tertiary drains (R3); five wastewater pumping stations (PSs) up to 16m^2 each, 6.5 to 8 m deep; (ii) dredging and embankment lining 457m of the Cau Rao River, construction of Cong Muoi Bridge 48.5m in length at the location of the existing Cong Muoi bridge; (iii) supplying and installing aerators using solar energy for Duc Ninh WWTP; (iv) supplying equipment for solid waste management (one garbage truck, 500 garbage bins 240-500 L each, 500 hand push carts, and one tank truck; and (v) construction of 11 school toilets and installation of six public mobile toilets.

The potential negative social and environmental impacts and risks related to the proposed investments listed above are discussed below.

3.3.1.1. Pre-construction Phase

During the pre-construction phase, the main potential impacts will be related to land acquisition and unexploded objects (UXO) left in project areas from the war.

1. Land Acquisition

Component 1 requires acquiring permanently 40,242.2 m^2 of land, including 33,697m^2 of paddy field and 6,545 m^2 of aquaculture ponds in Bac Ly and Dong Phu wards. Details of land areas to be acquired are shown in the Table 3.2 below:

Table 3.2 Areas and Types of Land to be Acquired– Component 1

No.	Ward/commune	Annual crop land (m^2)	Aquaculture pond (m^2)	Total (m^2)
1	Bac Ly	24,333	6,545	
2	Dong Phu	9,364		
Total		**33,697**	**6,545**	**40,242**

Source: Inventory of losses - 2016.

42 households HHs with 220 people will be affected by land acquisition under Component 1, of which 40 HHs will be severely affected[9]. Among the affected HHs, there are no HHs required to resettle, no vulnerable, poor, ethnic minority HHs, or HHs under preferred treatment policies. Table 3.3 shows the number of HHs affected under Component 1 by commune.

Table 3.3: Number of Affected HHs of Component 1

Ward/commune	Nos. of affected HHs	Total HHs surveyed	Number of people	Nos. of people		Nationality			
				Male	Female	Kinh		Other	
						HH	Person	HH	Person
Dong Phu	19	19	101	51	50	19	101	0	0
Bac Ly	23	23	119	61	58	23	119	0	0
Total	**42**	**42**	**220**	**112**	**108**	**42**	**220**	**0**	**0**

Source: Social economic survey data - 2016

[9] HHs losing 20% of productive land and >10% of productive land in cases of vulnerable HHs

Among the 220 people affected, 132 people work in the agriculture sector (rice cultivation and aquaculture). The daily lives of affected households will be disturbed or interrupted due to reduction or loss of agricultural land as sources of jobs and income.

Land acquisition under Component 1 will also affect some existing structures such as sewers, power lines and electric meters of the households living along the pipeline alignment. The number of existing structures to be affected by the Project are summarized in Table 3.4 below.

Table 3.4: Infrastructure Damaged by Component 1

Damaged objects	Unit	Quantity
Aquaculture pond	M^2	6,545
Electrical pole	Each	2

(Resettlement Action Plan of the sub-project)

6,545 m^2 of aquaculture pond being managed by Bac Ly Ward People's Committee will be acquired under Component 1. Currently there are no cultivation activities on these ponds hence the impact is minor. Reconstruction of the Cong Muoi bridge will affect two existing electrical poles and wires, and water piping running parallel 2m from the bridge. These would be relocated before the demolition of the existing Cong Muoi bridge. Power would be cut off for a short time (one or two days), affecting daily activities of local households and businesses.

Conclusion

To manage the potential impacts related to land acquisition, CCSEP has prepared a Resettlement Policy Framework (RPF) and a Resettlement Action Plan (RAP) has been prepared for each sub-project.

Dong Hoi Sub-project has prepared a Resettlement Action Plan to manage impacts related to land acquisition and clearance.

These resettlements plans should if managed well mitigate against potential problems arising.

2. **Safety Risks related to Unexploded Objects (UXO)**

Quang Binh province was affected severely by bombs and mines during the war. There are risks that some unexploded objects still remain in project areas. The civil works under component 1 involve relatively deep excavation from 2 to 9m for the construction of drains, manholes, and pumping stations. If there are UXOs left on the surface or underground in the construction areas, there will be very high safety risks which may cause losses of human life and project property.

Conclusion

This risk is assessed to be <u>SIGNIFICANT</u> and mitigation measures are presented in Section 5.3 of Chapter 5.

3.3.1.2. Construction Phase

The main construction activities in Component 1 will include site clearance, demolition of existing structures, construction of site-office, arrangements for workers' accommodation and temporary material and waste storage yards, mobilization of workers and construction plant to the sites, road surface cutting, excavation, piling, dredging, compaction, pipe installation, manhole construction, pavement/sidewalk reinstatement, concrete works and reinforced concrete works, embankment works, and waste transportation, etc.

Sources of the potential social and environmental impacts and main receptors during the construction of Component 1 are summarized in Table 3.5 below.

Table 3.5: Sources and Scale of Impacts in Construction Phase of Component 1

No.	Impacts/ Risks	Sources of Impact	Main Receptors	Impact level	Duration
1	Air Quality Reduction: increased levels of dusts and exhaust gas, odor, noises, vibration etc.	- Dust generated from excavation, loading/ unloading and transportation of construction materials (such as soil, sand, stones, cement) and wastes. - gas emitted from exhausts of cars, trucks, excavators, cranes etc. - Bad Odor from materials dredged up from Cau Rao River. - Noise from pile driving during construction of bridge and installation of sheet piles, from the engines of construction plants, unloading rocks on temporary material yards, - Vibration due to pile driving during construction of bridge.	- People living around the construction areas and material transport routes; - Workers on sites; - Infrastructure and landscape around the construction areas.	Medium	Short
2	Waste water generation	- Stormwater runoff through construction sites containing high contents of sediment;-wastewater generated from workers' camp; - Wastewater generated from washing of vehicles and construction plant, and construction materials preparation.	Surface water sources in the project areas, especially Cau Rao River water	Medium	Short
3	Solid wastes generation	- Excavated soil for pipeline installation and PS construction, dredged materials from Cau Rao River (salinity at 10‰); - Wastes from demolition of the existing Cong Muoi bridge; - Domestic waste from workers' accommodation; - Solid waste generated including cardboard, wood scraps, packaging material, waste mortar; - Hazardous wastes generated during cleaning and maintenance of trucks, construction plant, and equipment.	Residents along the pipelines, near the PSs, Cong Muoi bridge, and the workers' camps	Medium	Medium
4	Surface Water quality reduction	- Materials generated from riverbed dredging and embanking lining, demolition of the existing Cong Muoi bridge;	Surface water in Cau Rao river	Medium	Short

No.	Impacts/ Risks	Sources of Impact	Main Receptors	Impact level	Duration
		- Storm water runoff around the construction sites that may contain high level of suspended solid; - Wastewater generated from workers' camps; - Wastewater generated from washing of construction vehicles and plants. - Surface water quality mostly affected with increased turbidity and oil.			
5	Impacts on Biological Resources	- Bridge construction and dredging at Cau Rao river: the aquatic habitat lost, some move to the other river section, the zoobenthos might die, habitats of some terrestrial species (reptiles) may be lost, some vegetation and trees will be removed or cut down; - Waste disposal at Cau Cup landfill: surface runoff passing saline dredged materials may affect the growth, even kill vegetation cover or trees (eucalyptus, rubber trees, and bushes) in the surroundings. Some animals (small reptiles, mice, etc.) and insects will lose their shelters.	- Flora and fauna at Cau Cup landfill; - Aquarium in Cau Rao River.	Medium	Short
6	Urban landscape	- Loads of construction materials and waste, particularly bulky items, open channels affect urban landscape negatively. Most sensitive locations include tourism areas along Nhat Le coast, areas near cultural/historical structures, schools, hospitals, office;	Residents and visitors in the areas along the sewer and drainage construction routes, pumping stations, Cau Rao River and Cong Muoi Bridge.	Significant	Short
7	Soil subsiding and landslide risks	- Deep excavations for construction of sewers, pumping stations, toilet foundations and bridges may lead to soil subsiding and landslide risks. These may lead to damage to existing infrastructures and/or injuries even death to workers and local people	workers, local residents, the public Existing infrastructure	Medium	Short

No.	Impacts/ Risks	Sources of Impact	Main Receptors	Impact level	Duration
8	Flooding, sedimentation, erosion risks	- localized flooding may occur at/ or surrounding the excavated trenches and holes during heavy rain, temporary materials and waste loading areas may disturb and cause dangers to domestic activities of local households at construction sites; - The cofferdams built to isolate river sections for dredging and embankment lining will obstruct flows in the Cau Rao river. Upstream, river water will flow to the Phong Thuy canal; - Embankment lining of Cau Rao river will require removal of the vegetation cover at the river sides causing increased erosion potential; - Rain water run-off at construction material yards may cause sediment in the nearby drains.	Pipe installation and dredging at Cau Rao River	Medium	Short
9	Traffic Disturbance and Increased traffic risks	- Road excavation, temporary parking of construction plants or loading of materials and wastes may obstruct, disturb or even interrupt traffic in urban roads. - Road surface partially occupied by materials, open trenches, construction plants and wastes during construction phase will lead to increased traffic risks - Construction of Cong Muoi bridge will disrupt traffic in Le Loi road.	traffic means and drivers, pedestrians Local residents The public	Significant	Short
10	Damages to existing infrastructure and or disruptions to related services	- Excavation will take place along 24 km of the existing roads; electrical systems, water supply and drainage pipes, and some underground works along the routes will be affected; - Dredging and embankment lining at Cau Rao river will disrupt operation of seven storm water drains. Rain water will have to flow to other areas; - Existing powerlines and water pipes in the Cong Muoi bridge areas will be removed	Roads, existing houses, powerlines, water pipes, trees along the construction routes and the related services these infrastructures provide	Medium	Short

No.	Impacts/ Risks	Sources of Impact	Main Receptors	Impact level	Duration
		- Trees on sidewalks affected because hoisting bulky materials cause cutting; Excavation to 4-6 m deep may cause cracks to weaken structures including houses along the route			
11	Social impacts	- Drain and sewer construction may cause disruption to daily life and business activities of HHs, administrative agencies, and tourist activities along both sides of the construction roads; - Arrivals of workers to the construction sites may cause social disturbance - There is a risk that some workers may be involved in gambling or prostitutions;	People living along the road workers	Medium	Short
12	Impacts on cultural, historical, and religious works	- Dai Giac pagoda is located 200 m from the dredging site and 150 m from Cong Muoi bridge: dust, and temporary storage yards of construction materials and dredged sediments and construction wastes will affect the pagoda landscape; noise will impose negative impacts on religious operations; transport of materials will cause traffic risks to the people visiting the pagoda; and mobilization of a large workforce might impose security risks. - Tam Toa Parish is located nearby on Thong Nhat road which is the transport route for dredged materials and wastes to Cau Cup landfill. Transport trucks will increase traffic risks to travellers along this road; dust, emissions, and noise generated by transport trucks will affect religious activities of the parishioners at weekends, and cause impacts on the overall landscape of the road as well the view of Tam Toa Parish.	People visit the Dai Giac pagoda, Tam Toa Parish	Low	Short
13	Community Safety and Health	- Traffic risks will increase when roads and footpaths are narrowed down for construction. Disturbed	People living along the road workers	Medium	Short

No.	Impacts/ Risks	Sources of Impact	Main Receptors	Impact level	Duration
		ground, open channels for pipe placement, materials piled at roadside may cause accidents to drivers, pedestrians or local communities; - Dust and emissions from construction sites and along the roads may affect people's health - Construction of school toilets will impose significant safety risks to students if the sites are not properly managed			
14	Health and safety	All construction activities impose safety risks to the workers and local communities around the construction areas	Local community and the workers	Low	Short

The potential impacts are analyzed in details as below:

1. Air Quality Reduction

The levels of dust, NOx, CO, CO_2, SO_2, odor, noises, and vibration will rise in construction areas. The sources of these pollutants include: (i) dust comes from transportation, loading/unloading or temporary storage of construction materials (soil, sand, stones, cement) and wastes; (ii) Gases such as NOx, CO, CO_2 will be mainly generated from the exhausts of trucks, excavators, cranes, generators and other construction plants; (iii) Odor will be generated from the materials dredged from Cau Rao River; (iv) increased level of noise will result from the demolition of the existing Cong Muoi bridge and pile driving during the construction of the replacement bridges, and from unloading construction materials such as brick or crushed stones etc.; and (v) Vibration will be caused by pile driving during bridge construction, and roadbed compaction along the pipe trenches.

Each type of potential impact related to air pollution is discussed below:

(i)**Increased Dust level**

+ ***Dust generated from temporary storage of excavated or dredged materials***

Dust emission is calculated based on the volume of soil excavated from the works items of Component 1. According to Table 1.7 in Chapter 1, the total volume of excavated materials (not reused, to be disposed of) or dredged materials generated in Component 1 is 96,815 m^3 or 152,527 tonnes of which the amount of dredged materials from Cau Rao River is 13,214 m^3 (equivalent to 35,017 tonnes).

Dust emission at the temporary storage area is calculated as follows:

The amount of dust dispersed during excavation and leveling process depends on the volume of earthworks. The amount of dust to be diffused is calculated based on the pollution coefficient and volume of excavated materials. According to the guidelines of the World Bank (Environmental Assessment Source Book, Volume II), pollution coefficient E is calculated by the following formula:

$$E = K.0{,}0016.\frac{(\frac{U}{2{,}2})^{1,4}}{(\frac{M}{2})} \quad (1)$$

In which:
E - Pollution coefficient (kg/ton)
k – Granular structure with average value 0.35
u- Average wind speed at the project area (2.5 -3 m/s)
M - Average moisture of the material

Based on the average granular structure, average wind speed, humidity of embankment materials, etc., the calculated pollution coefficient is E = 0.00299 (kg /tonne)

+ The total amount of dust generated is 456 kg. With a construction period of 12 months, on average each day about 1.73kg of dust will be generated from excavation activities and 0.77 kg of dust emitted from dredging activities.

Dust may cause direct negative impacts on people living or doing business including tourism along the roads where drains, sewers, manholes, and pumping stations are constructed. People on the Ly Thai To - Le Hong Phong, Huu Nghi, Phan Dinh Phung, Truong Phap, and Hoang Sam roads will be the most affected by dust because drainage and sewerage sections to be constructed on these roads are from 300m-1,000m long. The potential impacts of dust will be significant as this is a populated area with many residential houses, restaurants and hotels.

> Dust consists of micro-sized organic or inorganic particles in the atmosphere in forms of flying dust, sediment dust, mist, smoke, and fog.
>
> – Particles > 10pm are dust, 10 -7- 0.1 pm are mist, and < 0.l pm are smoke.
> – Dust < 0.1 pm does not stay in alveolus.
> – Dust from 0.1 -T- 5pm stays in lungs (80 - H 90%).
> – Dust from 5 to 10pm gets into lungs yet being expelled out.
> – Dust > 10 pm often stays at noses.
> Dust in the atmosphere, especially particles of size < 5 pm might enter alveolus of the humans. Dust causes diseases such as rhinitis, sore throat, and bronchus aches. Dust also causes eyesores, red eyesores, blepharitis, etc. Prolonged intact with dust results in asthma, bronchus aches, bronchiectasis, and pneumonia.
> Source: http://lythuyetxaydung.com/cac-phan-tu-bui-va-tac-hai-cua-no-toi-suc-khoe-con-nguoi/ 4 October 2016

The amount of dust released during dredging at Cau Rao River (0.77 kg per day) will directly affect residents living near Dai Giac pagoda (250m from the temporary material yard). However, trees around the pagoda will ameliorate somewhat direct local dust impacts on the landscape and people visiting Dai Giac pagoda.

+ Dust generated during excavation for drains and sewers

Experience from similar past projects have shown that road cutting for drains and sewer installation if carried out in dry weather will lead to considerable amount of dust released to the surrounding environment. This is because the road surface contains mortar, sand, crushed stone and bitumen. The amount of wastes increase with increased road surface area disturbed, i.e. more dust is produced digging bigger trenches for bigger pipes. Pedestrians, drivers on motorbikes and any local residents will be most affected during road cutting.

With the application of specific construction methods, the volume of construction materials and waste temporarily loaded at the construction site will be controllable. Thus, the amount of dust generated will be relatively manageable. However, there are residential houses, schools, offices, hospitals located along a number of streets and these are sensitive receptors to dust. Dust generation is not avoidable but control measures can be applied.

+ Dust generated from transportation

10 tonne trucks will be used to transport the waste to the landfill. During transportation, dust is mainly released from the road while driving excavated soil and sludge/ sediment.

- *Transport route to Cau Cup landfill:*

The distance from construction sites to Cau Cup landfill is 8 km on asphalt roads. The total volume of materials to be disposed at this landfill is 152,527 tonnes. In total, there will be 15,252 truck trips to the landfill. The volume of generated dust is calculated in the following table:

Table 3.6: Dust and Gases Generated from Transportation of Wastes to the Landfill

Transportation Volume	Dust	SO2	NOx	CO	VOC
Emission coefficient (kg/1000km)	1.35	4.15S	14.4	2.9	0.8
Generated transportation volume (kg)	329.46	101.28S	351.42	70.77	6.10
Average generated transportation volume per day (kg per day)	2.50	0.77S	2.66	0.54	0.05

The calculated amount of dust generated is 2.5 kg per day, distributed along Thong Nhat, Ton Duc Thang, Nguyen Huu Canh roads. Among these, the potential impacts of dust will be most significant along the 900m of Ton Duc Thang road which is a populated area. The Thong Nhat and Ha Huy Tap roads mostly pass agricultural land with a limited number of residential houses, thus the potential impact of dust will be negligible.

- *Dust from transportation of construction materials (soil, sand, stones)*

The distances from borrow pits and quarries to the construction sites are 15-25 km. The total volume of construction materials needed is 509,178 tonnes (288,276 m^3). The volume of dust generated during transportation is calculated as follows:

Table 3.7: Dust and Gases from Vehicular Exhausts

Transportation Volume	**Dust**	**SO_2**	**NO_x**	**CO**	**VOC**
Emission coefficient (kg/1000km)	1.35	4.15S	14.4	2.9	0.8
Generated transportation volume (kg)	2,750	8,452S	29,329	5,906	509
Average generated transportation volume per day (kg/day)	10	32S	111	22	2

10 kg of dust will be emitted each day, distributed mainly on the roads from borrow pits to the National Highway 1A, which pass through sparsely populated areas, eucalypt forest, rubber, and poor forests. From the National Highway 1A to construction sites in the city, the population density is high, going past schools (Duc Ninh Dong Secondary School, Duc Ninh preschool, Chu Van a Preschool and Secondary school), a hospital (Dong Hoi General Hospital), and public markets along the roadsides (Con market). However by this stage in the journey dust emission will have dropped so the impact will be small. Thus, human impacts of dust from transporting materials from the borrow pits to the sites are small.

The potential impact of dust is assessed as *Medium* and can be mitigated.

(ii)**Air pollution due to gases emitted from exhausts of construction plants (CO2, CO, SO2, NOx, VOC)**

Gases emitted from vehicles exhausts

Calculation of dust emission also takes into account the amount of gases from vehicle exhausts generated during transportation as shown in Table 3.3 and Table 3.4. The calculated results show that gases from vehicle exhausts generated during transportation of wastes and materials as well as the evaluation of dust pollution from these sources is *negligible*.

Gases from vehicle exhausts from construction plants

The main diesel-engined construction plant used in Component 1 include excavators, bull dozers, graders, concrete mixers, etc. and cranes, piling machines and water pumps for bridge construction. In Component 1, excavators will be used for earthworks, and most now use diesel fuel. With a fuel consumption rate of diesel oil, dust and gases from vehicle exhausts pollution from a work shift is determined in the following table:

Table 3.8: Pollution Emission Level from Construction Plants

Machine/equipment	Fuel consumption (kg/shift)	Pollution Load (kg/shift)				
		NO_x	**CO**	**SO_2**	**VOC**	**Dust**
Excavator	94.5	1.89	0.473	18.9	2.36	0.473

The work norm for each loader and excavator shift is 1,000 – 1,200m^3 of soil. Thus, for excavation and dredging a volume of 228,400 tonnes (equivalent to 151,046 m^3), 125 -151 shifts are needed and the average construction time is 12 months. Accordingly, dust and gases from vehicular exhausts load caused by earthworks equipment during construction are shown in the follow table:

Table 3.9: Pollution Emission from Construction

Pollution Load	**Pollutant Load (kg per shift)**				
	NO_x	**CO**	**SO_2**	**VOC**	**Dust**
Pollution load generated throughout construction time (kg)	283.5	70.95	2.835	354	70.95
Average pollution load per construction hour (kg/h)	0.045	0.011	0.447	0.056	0.011

Potential health impacts of some gases emitted from vehicles

- CO enters the bloodstream, reacting with hemoglobin (found in red blood cells) to become a sustainable structure but cannot afford to load oxygen, this cause the body asphyxia. If getting a large amount of CO, people will feel headache, dizziness, and fatigue. Too much CO can lead to unconscious or suffocated status quickly. When oxidized, CO turns into carbon dioxide (CO2), CO2 also causes asphyxiation but not so poisoning as CO.

- SO2 can penetrate into the human body through the respiratory system, trespassing into the circulatory system. When exposed for long periods, it can create small acid particles which can penetrate into the blood vessels if their size is < 2-3 μm. SO2 can trespass into the human body through the skin and cause chemical conversion, leading to reduced alkaline level of blood. Ammonia can leak through urine and affects the salivary gland. Bigger concentration will cause increasing mucous secretion of trachea. This gas exposing to the eyes can form acid.

- NO2 concentration in the air with 5 ppm will have negative impacts on the lungs. Being exposed to the air for several hours with NO2 concentration of 15-20 parts per million can cause damage to lung, heart and liver; NO2 concentration in the air of 1% can be fatal in a few minute. NO2 oxidized under sunlight can create ozone gas causing tear and skin rashes. NO2 also contributes to asthma, even lung cancer, tracheal damage.

VOCs is the common name of liquid or solid substances containing volatile organic carbon. Some common substances as acetone, ethylaxetat, buthylaxetat ... They are less chronic toxicity. The main toxicity can include dizziness, drunken vomiting, swollen eyes, twitching, pneumonia. Only a few substances with chronic toxicity will cause blood cancer, and neurological diseases[10].

If a vehicle stops without turning off engine, localized air quality is reduced and can affect the people and workers. However, the above gas emission impact is considered to be small as gases

[10] http://tnmtvinhphuc.gov.vn/index.php/vi/news/Moi-truong/Tac-dong-cua-mot-so-khi-doc-den-suc-khoe-con-nguoi-71/

from such vehicular exhausts are dispersed quickly into the surrounding environment so the exposure time of workers is less. Excavator drivers are more directly affected by exhaust gases generated from their work. The effect is small but requires mitigation measures to avoid affecting workers' health.

(iii)**Odor**

Dredging and embankment lining of Cau Rao River will include excavation of top soil on the river bank, dredging and removal of the bottom sediment. During excavation and dredging, the structures of various soil layers and sediment will be disturbed and broken. Toxic gases including H_2S, mercaptan, amine, organic acid, and volatile organic compounds (VOCs) in the dredged materials will be released and cause odor.

Health Impacts of some gases:

- H_2S has rotten egg smell and be easily identifiable. If inhaled, victims may have asphyxiation, conjunctivitis because H2S effects on the eyes, then the respiratory system will be irritated strongly due to oxygen deprivation, then it can cause short of breath and stopped breathing. H_2S at high concentration can cause respiratory paralysis and suffocate.

- Alkaline NH3 can cause skin irritation and corrosion, absorbing water in the skin organization then makes protein denatured, fat decomposed and membrane structure destroyed. If inhaled, ammonia in the lung easily goes through the alveoli into the bloodstream, combined with hemoglobin, to sabotage the oxygen transportation function. If inhaled at high dose, ammonia may cause sore throat, tearing, cough, bloody sputum, chest pain, difficult breathing along with headache, vertigo, nausea, vomiting, exhaustion, especially pulmonary edema or respiratory synthesis in adults, and can rise to symptoms of respiratory stimulant.

According to research of Cambridge Environmental Research Organization on odor perception based on perception intensity: Odor Detection 1 Ou/m^3, light 5 Ou/m^3, specific odor 10 Ou /m^3 and according to the soil characteristic of the dredging and excavating areas of the project, odor is forecast at 8.42 Ou odor/s.m^2. Impacts of odor from dredging operations are shown in Figure 3.1.

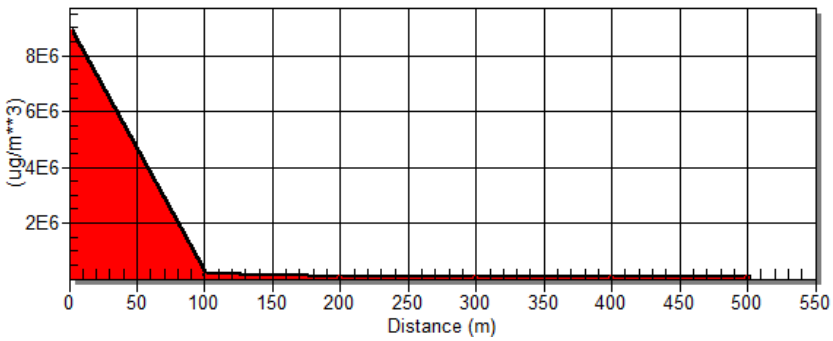


Figure 3.1: Impacts of Odors Generated During Dredging and Excavation

According to the above chart, the biggest impact of odor is 0-20 m from the external emission source, but by a distance of 100m the impact has dropped considerably. Because the nearest HHs are 250m from the dredging area, the odor generated while dredging will mainly affect workers.

The river section where dredging will take place and dredged materials temporarily disposed is barren land in a relative large open area, and the nearest houses are located 250m from the construction site. The potential impact of odor on local residents will be minimal and the odor generated will mainly affect the project workers. Experience from CCESP shows that odor was strongest in the first days after excavation and then it gradually reduced as the surface dried.

The river area is open and there were no previous historic complaints about odor from dredged materials during the earlier works.

Odor mainly from NH_3 will also be generated during the demolition of toilets at school before construction of new toilets. However, as the existing toilet at Dong Son No. 1 Secondary School will be demolished within a relative short period of time (a few days) the impact of these gases will be negligible.

Conclusion

Impacts of odors on the surrounding air environment are small and manageable.

(iv) Noise

The largest noise generated during the construction of pipelines and pumping stations is from the operation of concrete/ asphalt drilling-cutting machines, and piling machines. Lower levels of noise are generated from construction plants, engines of vehicles, and materials loading/unloading particularly stone unloading. Field surveys showed that the majority of the houses located along construction routes are surrounded by walls at least 1.5 m high, hence, the impacts of noise on road-side HHs will be limited. Moreover, noise from construction area occurs intermittently and in a relative short time, thus noise impact is rated as small. Office buildings, hospitals and health care facilities, schools, hotels, tourist centers and densely populated areas along the roads are the most sensitive areas towards noise. While noise impact is more sensitive at daytime to offices and schools, noise impacts are more sensitive at lunch time, night time and early morning in areas near healthcare and recreational facilities.

Loud noises may distract or disrupt daily activities at work, school, annoy fun activities, recreation, entertainment at hotels, restaurants, affect nursing periods and disease treatment at health facilities, cause insomnia or disrupt HHs' activities, etc.

Noise generated from dredging activities is mainly due to operation of 0.8 m^3 bucket excavators. According to Table 3.10, at distance of 45m or further, the noise level will be within allowable limits of standard NTR 26:2010/BTNMT. The dredging site is 250m from the nearest houses and 200m from Dai Giac Pagoda so the noise impact of dredging machines will be negligible to people in the nearest houses and Dai Giac Pagoda area.

Noises during demolition of the existing Cong Muoi Bridge will be mainly generated by operation of the concrete bombardment hammer. Demolition will take 7-10 days; the noise level generated from pile-driving during the construction of the new Cong Muoi Bridge will be limited as a bored piling method has been proposed. Noises from other activities during bridge construction will be only at a small level. Moreover, since the construction site is far away from residential areas, noise impact of bridge construction will be very small and negligible.

Because construction activities of school toilets are mainly manual, noises will be small. Materials transportation and stacking may temporarily cause some small impacts on teaching and learning activities. Regarding public toilet installation, noise generated during the installation of mobile toilets in public areas will not cause any significant impacts.

Noises level along the transportation routes including Tran Hung Dao, Thong Nhat, Le Loi, some sections of Quang Trung and Nguyen Huu Canh Roads, and the route from borrow pits in Quang Ninh and Le Thuy districts to Dong Hoi city may exceed standard QCVN 26:2010/BTNMT. However, these impacts are avoidable, temporary and can be mitigated.

The sensitive receptors to noise in the project area of Component 1 are listed in Table 3.10.

Table 3.10: Sensitive Receptors to Noise

No.	Construction area	Affected sensitive works	Distance to the construction site	Level of impact
1	**Hai Dinh Ward:** - Le Truc Road	Dong Hoi City PC	20m	medium
2	**Hai Thanh Ward:** - Truong Phap Road	Restaurants and hotels along construction routes	20-200m	medium
3	**Nam Ly Ward:** - Ton That Tung Road - Huu Nghi Road	Vietnam Cuba Hospital - Dong Hoi	100m	medium
		- Quang Binh University	300 m	small
		Phan Dinh Phung High School	100 m	medium
4	**Bac Ly Ward:** - Phan Dinh Phung Road	Bac Ly Secondary School No.2	50m	medium
5	**Duc Ninh, East Duc Ninh Wards:** Two extended roads - Le Loi Road - Ly Thai To Road	Dong Hoi Clinic	10m	significant
		Dai Giac Pagoda	200m	medium
		East Duc Ninh Secondary School	100m	medium
		East Duc Ninh Kindergarten	200m	small
		Duc Ninh Primary School	50m	medium
		Duc Ninh Secondary School	50m	medium
		Con Market	30m	significant
6	**Dong Son Ward:** - Ly Thai To Road	Dong Son Primary School No.1	50m	medium
		Dong Hoi High School	100m	small

Conclusion

Noise impacts by Component 1 construction activities are rated as small and can be mitigated.

(v) Vibration

Vibration will be mainly caused by construction activities related to bridge construction, piling and compaction. Vibration caused by compaction of piped trench will be negligible because the sand will be watered before compaction takes place. Typical vibration levels are specified in the following table:

Table 3.11: Vibration Level of Typical Equipment Within 10m Distance

No.	Equipment	Reference vibration (Vertical direction, dB)
1	Excavator	80
2	Bulldozer	79
3	Truck	74
4	Roller	82
5	Air compressor	81
6	Concrete hammer	97.5

Vibration impact from construction equipment is calculated by vibration attenuation with distance:

$$L = L_0 – 10\lg(r/r_0) – 8,7a\ (r- r_0)$$

In which: - L: vibration level in dB at a distance "r" from the source;
- L_0: vibration level in dB at a distance "r_0" from the source. In the project case, r_0 is vibration source and r_0 = 10m;
- a: intrinsic vibration attenuation coefficient at clay foundation, a = 0.5

Predicted results are presented in the following table:

Table 3.12: Vibration by Distance During Construction of Cong Muoi Bridge

Items	Max source vibration (r_0 = 10m) (dB)	Vibration level at a distance (*) (dB)			
		r = 5m	r = 10m	r = 15m	r = 20m
Concrete hammer	106.5	98.5	72.8	54.6	34.2
Construction of bored piles	97.5	92.7	69.4	46.4	23.8
QCVN 27: 2010, allowable level of 75 dB during 6÷21h and base level during 21÷6h					

Comparison of predicted results with QCVN 27:2010/BTNMT, at distances of >10m, vibration will be within allowable limits. The existing civil works are over 10m from the boundary of road construction and 250m away from the bridge construction site so they will not be affected.

Conclusion

Vibration levels are within allowable limits and can be managed.

Summary –Air, Noise, Vibration Impacts

During construction phase of Component 1, Thong Nhat and Nguyen Huu Canh Roads would be affected by both dust and noise. Other streets that would be most affected by dust include Ly Thai To - Le Hong Phong, Huu Nghi, Phan Dinh Phung, Truong Phap, and Hoang Sam, Ton Duc Thang. Tran Hung Dao, Le Loi, some sections of Quang Trung street would be affected by noise. Noise and Vibration levels are within allowable limits.

Conclusion

Impacts of air pollution are MEDIUM and can be mitigated. Noise and Vibration levels are within allowable limits and can be managed.

2. Wastewater/Stormwater Impacts

Wastewater generated during construction of Component 1 includes:(i) Domestic wastewater; (ii) Construction wastewater; (iii) Stormwater runoff.

(i) Domestic wastewater

Domestic wastewater will mainly be generated from workers' accommodation.

Based on the experience of similar projects implemented in urban areas in the past, there will be about 15 workers in each of seven contract packages for drains, sewers, and toilets construction, and they will rent local houses instead of setting up temporary camps. For the contract packages for construction of Cong Muoi Bridge and dredging of the Cau Rao River, camps will be set up onsite for 30 workers. Domestic wastewater generated from work camps will be calculated as follows:

Water demand for each worker stated in QCXDVN 01: 008/BXD is 45 litres per person per day, including water for washing, cooking and personal hygiene. The amount of wastewater generated is equal to 80% of water used daily. The amount of wastewater generated is 1.08cmd (32.4 m^3/month)

Domestic wastewater is characterized by containing high concentration of detergents, Coliform, BOD5, suspended solids, nitrogen (N), phosphorus (P)... Of these, approximately 58% and 42% is organic substances and inorganic substances, respectively.

Concentration of pollutants in wastewater is calculated by the following formula:

$$C = \frac{C_0 \cdot}{Q}$$

In which:

- C: Concentration of pollutants, (mg/l)
- C_0: Pollutant load, (g/day.night)
- Q: Wastewater discharge, (cmd)

According to pollutant emission factors of the World Health Organization (WHO), in developing countries the contaminant load of a person generated in a day is as follows:

Table 3.13: Pollutant Load in Domestics Wastewater

Parameter	Emission coefficient (*) (g/person/day) mg/l	Pollutant load (kg/day)	Concentration (mg/l)	QCVN 14:2008 Column B
BOD_5	45 - 54	1.35 -1.62	1,250– 1,500	50
Suspended solids	70 - 145	2.1-435	1,944 – 4,027	100
Oil and grease	10 - 30	0.3- 0.9	277 – 833	20
Total Nitrogen	6 - 12	0.18 – 0.36	166 – 333	50
Ammonium	2.4 - 4.8	0.072- 0.144	66– 133	10
Total Phosphorous	0.8 - 4	0.024 – 0.12	22– 111	10
Total Coliform (MNP/100ml)	10^6 - 10^9	$20x10^3$ –$20x10^6$	$22x10^6$ – $22x10^9$	5000

(*) Source: World Health Organization (WHO)

With the pollutant load forecasted in the table above, the concentration of some pollutants in untreated wastewater generated from workers' camps may be higher than the standards set in QCVN 14:2008/BTNMT several times. As construction phase of component 1 lasts 24 months, the volume of wastewater generated from each camp would be 1.08 cmd or 777m^3/2 years).

If not managed properly, the generated wastewater will become stagnant, smelly, causing negative visual impacts, and localized pollution. Stagnant wastewater will be a favorable environment for water-borne diseases vectors to develop affecting the health of workers and local residents. Cholera, dysentery, typhoid, and dengue fever are well-known water borne diseases. The untreated wastewater could in addition enter the Cau Rao river and cause water pollution.

Conclusion

The potential impact of domestic wastewater is at a MEDIUM level and can be mitigated.

(ii) Construction Wastewater

In Component 1, construction wastewater will come from materials preparation such as concrete mixing, washing of construction equipment and tools, maintenance of constructed works, and cleaning the trucks. The amount of wastewater generated depends on the number of vehicles, equipment used, construction method and the workers' skills and awareness, and weather conditions (in the rainy season, more frequent vehicle washing is required due to the mud clinging); car wash water standards for a large vehicle is 300-500 liters (defined in Section 3.4 -TCVN 4513:1988).

The concentration of impurities in construction wastewater is presented in Table 3.14:

Table 3.14: Pollutants Concentration in Construction Wastewater

Target	Unit	Concentration of pollutants	QCVN 40 - 2011/BTNMT
pH	-	7.99	5.5 – 9
BOD_5	mg/l	223.0	100
TSS	mg/l	42.926	50
Ammonium	mg/l	9.6	10
Total Nitrogen	mg/l	39.27	40
Total Phosphorous	mg/l	4.25	6
Zn	mg/l	0.004	3
Pb	mg/l	0.055	0.5
Oil and grease	mg/l	3	10
Coliform	MPN/100 ml	54×10^4	5,000

Therefore the potential impacts of construction wastewater would be very limited and manageable.

(iii) Stormwater runoff:

+ Stormwater runoff at construction sites of drains, sewers, and pumping stations:

The total calculated construction area of drains, sewers, manholes, and pumping stations is 89,105 m^2, covering the road sides of 25 roads and five PS sites (as detailed in Table 1.3). As per the description in the condition baseline section, the highest rainfall measured at Dong Hoi Gauging Station is 554.6mm (Table 2.1, Chapter 2). Hence, the total surface runoff corresponding to the highest daily rainfall in the entire construction area is calculated with the following formula:

$$Q = \Psi * F * q = 89{,}105\ m^2 * 0.5546 m/day * 0.3 \approx 14{,}825\ cmd. \quad (1)$$

- Ψ: Surface runoff coefficient for the project area is 0.3. (According TCXDVN 51:2006, the flow coefficient for leveling ground is 0.2 to 0.3. Based on the characteristics of the surface of embankment construction area, select Ψ = 0.3).
- F: Land area: 89,105 m^2.
- q: Rainfall intensity: 554.6 mm/day.night.

Accordingly, the average highest rainfall in one road or at one PS construction site will be 988.35 cmd. This stormwater would follow existing drains to final receptors such as Phong Thuy canal, the ponds, Dong Son, Tay Huu Nghi, Khe Duyen lakes, Cau Rao and Le Ky river, etc.

+ Stormwater runoff at construction sites of Cong Muoi bridge, dredging and embankment lining of Cau Rao river:

The total construction area is 22,414 m^2, and as per the description in the condition baseline section, the highest rainfall measured at Dong Hoi Gauging Station is 554.6mm (Table 2.1, Chapter 2). Hence, the total surface runoff corresponding to the highest daily rainfall in the entire construction area, following formula (1), is 3,729 cmd.

Of these, about 70% of calculated volume of water will flow to the Cau Rao River, the remaining 30% will flow into the lowland surrounding the construction sites.

+ Stormwater runoff at disposal sites:

Dredged materials will be disposed of at six existing abandoned aquaculture ponds with a total area of 0.3 ha located along the dredging area. The rainfall calculated with formula (1) is 499.14 cmd. The surface runoff will first fill in the drains, holes and ponds before entering the Cau Rao

river, then flowing to the Le Ky river.

At Cau Cup landfill (land area of 13.5 hectares, the highest daily rainfall day of 554.6mm), the calculated total surface runoff is approximately 135,000 m^2, and 22,461 cmd as calculated with formula (1). Approximately 50% of the 22,500 m^3 surface runoff will flow into the existing stormwater collection ditches around the landfill, the rest will either penetrate into the soil or overflow on to the ground in the area to the Loc Ninh lake which is 800 -1,000m at the east of Cau Cup landfill.

The concentration of pollutants in stormwater is shown in Table 3.15 below:

Table 3.15: Pollutants Concentration in Stormwater

No.	Composition	Concentration (mg/L)
1	Total nitrogen	0.5 – 1.5
2	Total phosphorous	0.004 – 0.03
3	COD	10 – 20
4	TSS	10 – 20

(Source: Hoang Hue, 1996)

As discussed above, the main pollutants in different types of wastewater generated in construction phase of Component 1 would be mainly BOD_5, TSS, nutrients (N and P), oil and grease, and coliform. Wastewater may cause soil and water pollution, localized flooding or sedimentation as discussed in relevant sections below. The volume and quality of wastewater generated would be manageable,

Conclusion

Impacts of wastewater/stormwater are MEDIUM and can be mitigated

3. Solid Wastes Generation

During construction of Component 1, solid wastes generated mainly include: (i) domestic solid wastes from workers' camps; (ii) construction solid wastes; (iii) excavated and dredging materials; (iv) small quantity of hazardous wastes.

(i) Domestic solid wastes

Domestic wastes would mainly generate from the workers' camp, the composition would be mostly waste from food processing and include some packaging materials. On average, each person generates 0.7kg of solid waste per day[11].

30 employees will reside in the camps set up by the civil works in Cau Rao River and Cong Muoi bridge. 21 kg of domestic waste will be generated each day from these camps. With a 24-month construction contract, the total amount of domestic waste generated from these camps will be 11.1 tonnes. If not collected, stored and managed properly, such domestic wastes may cause odor pollution, rodents and other disease-causing organisms such as flies and rats will be attracted to the area and may affect the health of the workers and the public. Leachate from this garbage will cause localized contamination of soil and water. Also, packaging materials may follow the wind littering o the surrounding areas such as residences on Le Loi Road, Dai Giac Pagoda causing bad aesthetic impacts.

Conclusion

The impact levels are minor and controllable.

(ii) Construction solid wastes

Wastes generated from construction activities include: containers and packaging materials and

[11] According to 2014 survey data from Quang Binh Environmental, Protection Department

unused/redundant construction materials such as sand, rock, cement, concrete spillage, damaged concrete structures etc. The amount of construction waste generated depends on materials management practice, the skill of the workers, and the measures applied to collect, reuse and/or recycling practices. If not collected properly, on average it is estimated that from 5 to 10 m^2 of roadway or road side area will be occupied by temporary waste dumps along the construction sites of sewers and at the pumping stations and 200m^2 will be occupied for the dredging and embankment site of Cau Rao River, and construction of Cong Muoi Bridge. However, in practice, the amount of waste generated will be less as some materials can be reused or recycled. For example, cement bags, iron and steel scraps can be sold to recycling dealers which are available in Dong Hoi. The remaining waste could be transported for disposal at the Cau Cup landfill.

Conclusion

The potential impacts related to construction solid waste are assessed to be small and can be controlled.

(iii) Excavated and Dredging Materials, Waste from Demolition

The volume of waste generated from the construction of drains and sewers, pumping stations and manholes is estimated at 138,202m^3 (equivalent to 194 tonnes). The volume of concrete, broken bricks, and steel generated during dismantling Cong Muoi bridge is 380 m^3 (950 tonnes). The dredged sediment volume in Cau Rao river is 13,214m^3 (35.017 tonnes). There is also a small amount of waste generated from the demolition of an existing toilet of Dong Son Secondary School. Therefore, the total quantity of waste (excavation, dredging and demolition) generated under k 1 is estimated at 151,796m^3 (229,150 tonnes). Land will be needed for the disposal of these excavated and dredged materials. The Cau Cup landfill has been selected for final disposal.

It is noticeable that the dredged material from Cau Rao River is saline (approximately 10%). The implications of saline dredged materials for water quality is discussed under subsection 4 and its potential impacts on the biological settings in the project area is discussed under subsection 5 below.

Among the solid wastes mentioned above, the potential impacts related to dredging materials from Cau Rao River could be most significant thus appropriate mitigation and monitoring measures should be considered.

(iv) Hazardous solid waste

A small amount of hazardous waste may be generated during the construction process, including gasoline, waste oil, oily rags, paint containers mainly from repair work, maintenance of vehicles and machinery, construction equipment, etc.

If solid waste is not well managed, it will cause significant environmental impacts and risks due to its toxicity and capability to spread and enter stormwater runoff.

Conclusion

The impact level of solid waste is MEDIUM and can be mitigated .

4. Water Quality Reduction

Surface water quality in the project area can be affected with increased suspended solid contents and turbidity, some oil and grease, BOD, nutrient contents, salinity and DO (related to flow circulation).

Solids contents and turbidity, oil and grease.

The increased contents of suspended solids in surface water would be sourced from (i) surface runoff passing disturbed areas and temporary loading areas of granular construction materials

and wastes; (ii) construction wastewater containing high contents of solids; (iii) washing of construction plants and tools; and (iv) the wastes and materials from bridge demolition and reconstruction;

With regards to pipeline installation and construction of pumping station, if large areas or many locations in the project area are disturbed at the same time, large amount of excavated or filling materials are temporarily loaded at one time, the granular materials would be washed away by rainwater causing increases in solid contents and turbidity in the surface runoff if no mitigation measures are applied.

Increases suspended solid contents in water would affect aquatic life (respiration and hypo synthesis), causing sedimentation in drainage channels and water bodies and affect other water users

However, in practice, the risks of increased suspended solids and turbidity in water is low due to: (i) the works are divided into construction packages and not all are to be implemented at the same time; (ii) the land areas to be disturbed and excavation volume at each construction site of the pipeline, the pumping station or school toilets are limited when a successive construction method is applied.

The risk would be at medium level at the Cau Rao dredging area where the water drained from dredged materials may contain high solid contents and affect the water quality at the receptor.

The demolition of the Cong Muoi bridge, if not properly managed, could cause fine/granular material to enter the river and cause increased solid contents in the water quality. For the Cong Muoi bridge construction, the risk would be from the oil leaked into the river from the barge supporting bridge construction, and the mud dropped into the river while being removed from the riverbed for pile foundation construction.

Construction materials preparation if required would be mostly at the drains to be built onsite, the lining of the Cau Rao river, and the school toilets. If not properly managed, wastewater would enter the nearby drains and water bodies causing increased solids and turbidity.

If machine and equipment are washed in water bodies, water quality would be affected with the added contents of solid, oil and grease. However, the risk is low and manageable. This is because for the pipeline packages (in which pre-casted pipes are installed), most of the works would be done by machines (cranes, bulldozer, excavator etc.). The manual works carried out by the workers would be mostly for finalization and site cleaning (for which mostly shavers and sweepers would be used). Bridge construction and river dredging would follow similar practice. Construction plants such as trucks, vehicles, bulldozers, excavators would not be washed on-site in the city at or nearby construction sites but in other designated areas or workshops where wastewater is not discharged directly into any water bodies. Only in regarding to embankment lining or drains to be built on-site, would some works be done manually by the workers with mason tools. Washing of manual tools depends on availability of water and workers' awareness. Tool washing practice can be monitored and is manageable.

BOD (Biological Oxygen Demand), DO (Dissolved Oxygen), nutrient contents (N, P) and Salinity Impacts of Wastewater from Workers Camps

Domestic wastewater from worker contains high contents of BOD_5, N and P, Coliform. At camps of 30 workers, wastewater was estimated at 1.08 cmd (777,600 m^3/2 years), if untreated but discharged directly into the environment, it can contribute to the deterioration of water quality in the surrounding area.

Impacts of Coffer Dam In The River to water quality

According to the dredging method described in Chapter 1, the Cau Rao river would be dredged in two stages, 200 and 275 m each time. Coffer dams will be built at the two ends of the dredging section. River water will be pumped to the downstream section prior to dredging.

Figure 3.2: Dredging section and the existing sluice gate

There is an existing sluice gate about 1.5 km upstream of the dredging section (Figure 3.2 above) and the gate is always closed in the dry season. When coffer dams are built for river dredging, water in the river section between the gate and the coffer dam would not be running. Fresh water recharge from rain water is limited in dry season. Some wastewater may be running into the river. The concentration of SS, BOD, nutrients, oil and grease etc. in river water there would be increased. Decomposition of organic matters in the water lead to DO reduction and some toxic gas may be released. Water in this river section would become stagnant if no mitigation measures is applied. Stagnant water causes visual impacts, may generate bad odor and pose water-borne diseases risks to the public if the river section is blocked for 4 months. The area potentially affected by the coffer dam is circled in the map in Figure 3.2 above. It includes the main river channel and a lake connected to the river. This potential impacts can be monitored, and pumping machines or artificial aeration can be applied if proven necessary to keep the water quality in the blocked river section at an acceptable quality.

Potential Impacts of temporary storage of dredged materials

Dredged materials will be stored temporarily in the abandoned ponds located along the river. The dredged materials would have salinity at around 10% and the water drained from such materials would be brackish water and may contain high contents of solids. If not properly managed, that flow of water would cause soil and water pollution at the receptor and cause harm to the vegetation which it passes through. These potential impacts are manageable through the dredging method described in Chapter 1 and additional mitigation measures detailed in Chapter 5.

Potential Impacts of dredged materials at final disposal site

When dry enough, dredged materials will be transported for being disposal Cau Cup landfill. If not managed properly, salinity from this saline materials may follow stormwater runoff to cause pollution to soil and water, cause harm or kill the vegetation and trees in the green areas at the landfill.

Conclusion

The impact level of dredged materials is MEDIUM and can be mitigated .

5. Potential Impacts on Biological Resources

As discussed in Chapter 2, biological values of the ecosystems in the Cau Rao river are very limited due to the following factors:

- The river is man-made, approximately 4 km long, and originated from paddy fields upstream. Only the downstream is connected to the Le Ky which is a natural river;
- Along its length, the river is fed by drainage channels in the catchment but by no natural streams or river;

- The main function of the river is drainage for an urbanised catchment. The catchment has been largely modified by extensive human activities over a long period;
- Currently river water is polluted with BOD_5, COD exceeding standards by 2-3 times (Table 2.7, Chapter 2); The remaining sections of the river have been modified previously by other provincial-financed projects, and by the CCSEP;
- There are other natural rivers in the area, such as Le Ky and Nhat Le Rivers with more diverse aquatic ecosystems as described in Chapter 2.

The above finding has been e supported by sampling results which show that the composition of existing aquatic species in the river is poor in both quantity and diversity (Chapter 2). There is no known rare or endangered species in the project area.

As dredging take place in the dry season only when the sluice gate is closed, biological impacts of dredging are limited in the section from the sluice gate to the end of the dredging section only.

Before dredging, coffer dams will be built at the two ends of the dredging section. Water will be pumped out to the downstream section, thus most of aquatic species presence in the water, if any, would follow the flow to the other river section thus the effects on them would be marginal and negligible. When dredging taking place, the benthic living in the mud layer which is about 0.5 m thick will be affected. They will be removed from the river bed together with the sediment. This potential impact is unavoidable. The area and volumes of sediments to be removed from the river is limited mostly within 475 m of the river section to be dredged. Therefore the potential impacts on the aquatic species on the Cau Rao river is limited and manageable.
During dredging, when the coffer dams exist, water in the river section between the sluice gate and the coffer dam will not be running, dissolved oxygen could be decreased, toxic gas might be generated from the decomposition of organic matters in the water under anaerobic conditions, water could become stagnant, aquatic organisms could be affected or even killed. and there could be some visual impacts as well as public health risk. This potential impact is able to be mitigated by monitoring and pumping stagnant water out or creating a diversion canal.
The affected biological setting is recoverable after dredging is completed and the coffer dams are removed. Sediments from upstream would continue to flow into the river section. Meanwhile, as the river section is affected by tide and connected to the Le Ky river which is a natural river, there will be movements of sediments and aquatic organisms between the Cau Rao and Le Ky rivers. Therefore, the potential impacts related to aquatic biology of the Cau Rao bridge are localized, insignificant and recoverable.

Figure 3.3– Fish catching at Cau Rao river after dredging

The photo above show that local people continued fish-catching after the completion of river dredging and embankment lining of some river sections under the CCSEP. Interviewees said they had caught various kinds of fish, shrimp, and crab.

As noted under the solid waste sub-section, the dredged materials from the Cau Rao river are saline. If not properly managed, saline water leaking from the dredged material could cause

damage or even kill the plants through which it passes. If rainwater runoff flowed through the saline materials before flowing to another vegetated areas, similar effects would happen although water flow would be less saline than the leakage water. Tolerance limits of some fauna species are indicated in the box below.

Tolerance limit of some plants to salinity:

Salinity at 2‰ cause bad effects to orange and pomelo trees;

Mango: 4‰, sapodilo 10% o

Sugar cane: 2 ‰, coconut: 7% o, young rice: 2% o but 0 during flowering

Corn: 1%o, tomatoes: 2%o, pumpkin: 4%o, soybean: 5‰

Source: http://www.vienmiaduong.vn/vi/detailkhoa.php?idTin=793, accessed 21 October 2016

The information given in the above box shows that if saline water from dredged materials enters crop land, the plants would be die. This potential impact and risk is at a moderate level as the dredging area is in an area which has been largely urbanized and the risk is avoidable through construction methods and control measures.

Some parts of the existing green area (eucalyptus, rubber) in the area around Cau Cup Landfill may be affected or killed if surface runoff passes through the saline sediment (salinity at 10%0, dredged from the Cau Rao River and dumped at the Cau Cup landfill) before entering the green area. The existing vegetation cover there could also be disturbed by the trucks and the workers (Figure 3.4). According to the City Master Plan, the temporary storage of dredging material will become riverside green area. Therefore, the potential impacts on biological settings in the project area would be manageable. The mitigation measures are presented in Chapter 5.

Figure 3.4: Existing vegetation cover at Cau Rao riverside and Cau Cup landfill

Conclusion

The impact level of saline water intrusion is MEDIUM and can be mitigated.

6. Impacts on Urban Landscape

The installation and construction of 23 km drains and sewers, 41 km of tertiary pipelines, five pumping stations, demolition of the existing Cong Muoi bridge and the reconstruction of a new bridge at the same location, necessarily means the landscape in Dong Hoi city will be affected significantly during the construction phase of Component 1 (two years).

The construction sites of drains and pumping stations with fences, bulk materials, excavated soil, open channels under construction will cause negative visual impacts and affect the urban landscape. This impact will be most significant on routes with many hotels and restaurants such as Truong Phap Road as shown in Figure 3.5.

The temporary storage of waste, parking of construction, and the presence of worker camps in the waterfront of Cau Rao River will also affect the landscape in this area, particularly the area near the Dai Giac Pagoda area which is 200m from the dredging area.

Conclusion

Impact level: SIGNIFICANT, but can be mitigated against

7. Soil Subsidence and Landslide Risks

The project will construct drains D800-1,500 and relatively large box culverts on Ly Thai To, Le Hong Phong, Ton That Tung, Trung Truong, Ngo Gia Tu, Le Truc, To Huu, Nguyen Van Linh, and Huu Nghi roads. Some pumping stations will also be constructed that involve deep 6-8 m deep excavations. Due to the project area being located on weak geological foundations (load capacity <1 kg/cm^2), the risk of subsidence, slips and landslides in deep excavations is high. However, this risk would be limited by the construction methods described in Chapter 1, in which Larsen Sheet Steel piles will be used to protect the slopes and walls when excavation is deeper than 2 m.

At the temporary disposal site, with 13,214 m^3 of dredged material from Cau Rao river to be disposed in an area of 1ha, the height of the dump would be 1.3 m which is 0.3m higher than the existing ground level in the surrounding area. Hence, the risk of land slide at the dump is low.

With 83,222 m^3 of excavated materials and waste to be disposed of at the Cau Cup landfill with a total land area of 13.5ha, the height of the dump will be 0.6m higher than the existing ground level so the risk that soil subsidence or landslides is very low and can be mitigated against further. In case the wastes are dumped at only part of the Cau Cup landfill, the height of the dumps would be higher and there would be some risks that the materials could slide down the slopes. This risk can be mitigated with the construction methods presented in Chapter 5.

Conclusions

Impact level: MEDIUM and can be mitigated

8. Flooding, Erosion and Sedimentation Risks

The temporary storage of materials or wastes, if not well controlled, may block existing drainage ditches. Localized flooding may occur, the areas may become muddy in rainy weather, affecting people's daily life.

During construction of drains and sewers, construction materials and excavated soil are normally stored near the excavated trenches. In the rainy season, if excavated materials are not well controlled, they will block existing drainage ditches and excavated trenches, resulting in sedimentation and slow discharge of stormwater, and high possibility of localized flooding at the construction sites and the surroundings.

The construction site of each pumping station occupies an area of 26-40 m^2. During temporary loading of excavated materials, such materials will cause sedimentation in the drains in the surrounding area if not managed well. (At present there are no canals, irrigation or drainage canals around the pumping stations).

As described in Chapter 1, dredging of Cau Rao River will take place during six months in the dry season, when rainfall is low. The works will be executed in sequence in each of the two sections, 200 m and 275 m each. As discussed earlier, dredging only takes place in the dry season when the sluice gate at the upstream end of the canal is closed, thus dredging activity should not cause any impacts on hydrological regimes upstream of the gate. After dredging, cofferdams will be demolished and the flood discharge control function of the Cau Rau river reinstated.

Because of the coffer dams built for dredging of Cau Rao river, intake flows of the balancing lake will be affected and the lake flows will be blocked. However, as the construction time will last for only 6-9 months during the dry season when the lake water level is flow, such impact will be minor.

During dredging time, since the flows are low, flow pipes can be provided to ensure flows of the affected balancing lake and seven stormwater drains and divert water to the downstream of Cau Rao river.

Construction of Cong Muoi bridge will be carried out after dredging of Cau Rao River and the bridge piers will be constructed by the bored piling method. The piles have an encirclement area of 20.4 x 9.2m which is less than the width of the dredged river. Water can therefore still flow and the risk of flooding and sedimentation is unlikely.

Figure 3.5: Truong Phap road

The total construction materials mass of Component 1 is 147,681 tonnes, transported to material parking yards in accordance with actual construction progress. The material yard at the construction site at Cau Rao river and Cong Muoi bridge is the largest, covering an area of 300 -500 m^2, and 30m distant from the nearest surface water sources. During heavy rains, construction materials might enter the surrounding drains, block such drains and reduce drainage capacity, hence, increased possibility of localized flooding.

Cau Cup landfill has an existing stormwater drainage system. A total of 83,222 m^3 of materials will be transported to this landfill through 15,252 trips of trucks. If not properly managed, the wastes may spread or go into these drains, causing blockage and localized flooding risk. This potential impacts are localized and manageable.

Conclusion

The risk of flooding and sedimentation is MEDIUM, can be mitigated

9. Traffic Disturbance and Increased Traffic Safety Risks

With a total of 23 km of combined drains and sewers (with diameters up to 1.5 m or box drains BxH = 3x1.5 m), 41 km of tertiary pipelines (D150-300) to be installed, five pumping stations to be built and the existing Cong Muoi bridge to be demolished for reconstruction, the traffic in Dong Hoi city will be affected significantly during construction. Traffic density will increase and traffic jams may occur during peak hours when road width is narrowed for construction. Some small roads may be blocked if the remaining road width is not sufficient for traffic flow, or when the existing bridge is demolished. Traffic risks will be increased when traffic density increases. In addition, traffic risks will also be increased as the fences, temporary loaded materials, construction plants may obstruct vision of drivers. The open trenches, movement of construction plants, loading and unloading of bulky pre-cast pipes, etc. will also cause safety risks to the public travelling on the road.

The potential impacts on traffic will be manageable as there are seven packages for pipeline installation. There will be some overlapping of packages as contractors may construct packages in succession.

The potential impacts on traffic along the streets where relatively large pipes will be installed are discussed in Table 3.6.

Traffic will be affected the most during project construction on the following streets: Le Loi - Ly Thai To, Phan Dinh Phung, Truong Phap, Quang Trung, Ton That Tung.

Demolition of the existing Cong Muoi bridge and construction of a replacement will take 12 months. Traffic flow between the two ends of this bridge on Le Loi Road will be disrupted. However, disruption will not cause adverse impacts because there is an existing bridge (12 m wide) parallel to Cong Muoi bridge, located 600 m upstream of Cau Rao river. From each end of Cong Muoi bridge, vehicles can follow Nguyen Huu Tho or Thong Nhat roads and cross the bridge on 23/8 road as shown in Figure 3.6. Hence, the impacts on traffic on this route will be at a medium level.

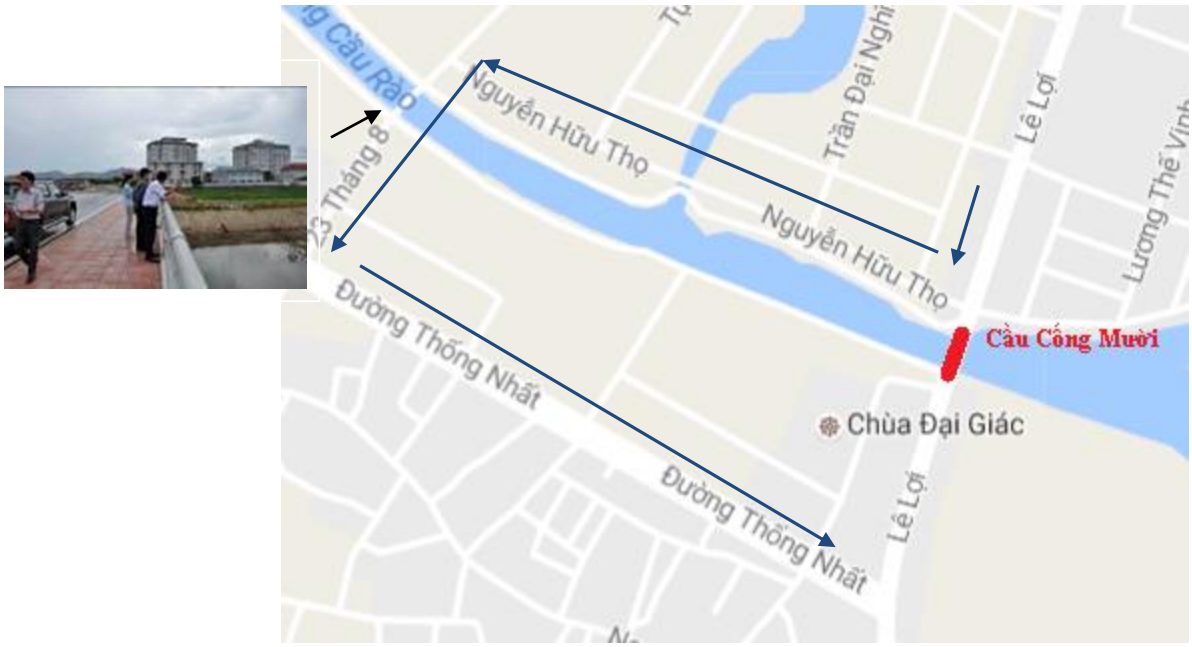


Figure 3.6: Traffic Divergence Route for Cong Muoi Bridge

Conclusion

Impact level: <u>SIGNIFICANT</u>, but can be mitigated

10. Impacts on Infrastructure and Disturbance to Related Services

Existing infrastructure may be affected by construction activities such as road cutting, excavation, operation of cranes with bulky construction materials and piling. Specific impacts are as follows:

- 26 roads with a total affected length of 23 km will be affected. Road structures will be changed and the quality of road surfaces may decline; during road cutting for construction trenches and road reinstatement, road surfaces may crack at the joints with old road bases and rain water might penetrate through such cracks and reduce road surface quality;

- Seven drains along 475 m of the dredging section in Cau Rao river will be blocked during dredging;

- The existing Cong Muoi bridge will be removed;

- The existing underground structures such as power, water pipelines, cable, etc. will be affected or damaged during earthworks carried out during the construction of drains where excavation can be 1.5 to 4.5m deep. Related services such as water supply, power, television, internet etc. may be disrupted;

- Operation of cranes when loading or unloading bulky materials may cause damage to the existing power lines that run along main streets. In such cases, power supply will be disrupted,

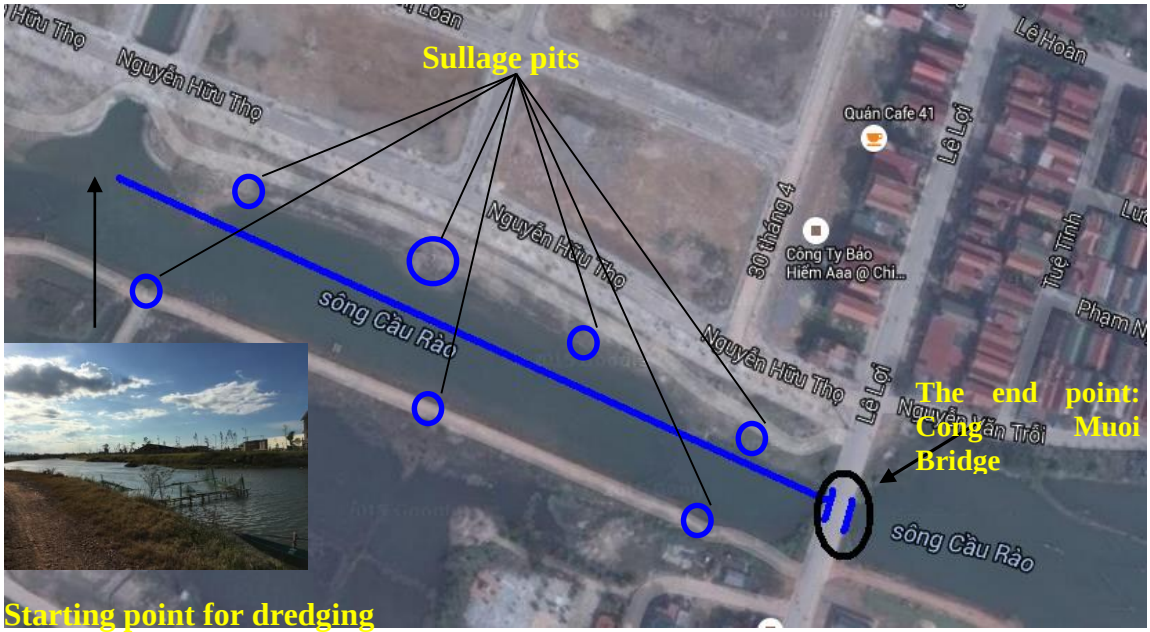
affecting the daily life of people and may cause economic loss (in the case of line replacement) of affected households;

There are two electrical poles at the two ends of the Cong Muoi bridge, and an existing water pipeline runs along this bridge. These facilities will also be relocated before the demolition of the existing bridge. Damages or service interruptions may be caused during the relocation;

- Existing trees on the sidewalk (shade trees, 4-6 m tall, no ancient trees) may be affected by crane operations on bulky materials;

- Houses, yards, walls, particularly existing weak structures along the construction area may be cracked due to construction of large drains and ditches requires broad and deep excavation of canals (B x H: 3m x 4.5m). In the pumping station area, excavation depth is 5-9m, but there are no houses around to be affected. There are housing works in the distance of 200 - 250m, on two sides of Cau Rao River, Cong Muoi Bridge, but cracking risk is small.

- Seven sullage pits may be affected by river dredging and canal lining.



Conclusions

Impact level: <u>MEDIUM</u> and can be mitigated.

11. Social Impacts

Social impact may be caused mainly related to mobilization of workers from other localities to the project area. Community disturbance caused by increased level of dust and noise, traffic disruption and increased safety risks and disruption of existing public services may arise.

Construction of Component 1 will mobilize up to 150 employees working for different contract packages. Each group will typically have 10-15 people, and up to 60 people coming from other localities will be mobilized to work at the construction sites at the Cau Rao River. Mobilization of workers from other localities may lead to conflicts between the workers and local people due to differences in behavior and customs, jobs and income, traditions, or if the workers get involved in gambling, drinking and prostitution.

Excavation that creates open channels, temporary storage of materials, tools and waste, etc. may cause social disturbance as these activities may obstruct access to houses, or disturb daily activities of roadside households. Particularly, business and incomes of roadside shops may be affected or even reduced. Conflicts between construction teams and local people may arise due

to disturbance to urban landscapes, increased localized dust levels and safety risks, traffic obstruction, income reduction, etc. Survey data showed that about 200 business HHs located along construction routes will be affected with access to their houses, noise, dust, odor, and increased traffic risks. Social impacts related to drain construction will be manageable as the successive construction methods will be applied, disturbances will be temporary and last in a limited duration for about 10-30 days.

Conclusion

Level of social impacts <u>MEDIUM</u> and can be mitigated.

12. Impact on cultural, historical, and religious activities

The project will not exert any major infringement on cultural, historical, and religious activities. Nevertheless, construction projects may temporarily affect cultural, historical, and religious activities. This may include inconvenience of access, smoke and dust hindrance and construction work may affect tourism activities. Cultural and religious institutions that can be affected by the project operation are as follows:

- Dai Giac pagoda is located 200 m from the dredging site and 450 m from the Cong Muoi bridge. Local people often visit the pagoda on the first and the full moon days or the Lunar New Year. Dredging activities and embankment lining of 475 m of Cau Rao River, and demolition of the existing Cong Muoi Bridge as well as construction of the new bridge will release dust, and temporary storage yards of construction materials and dredged sediments and construction wastes will affect the pagoda landscape. Noise may negatively affect religious ceremonies; transport of materials will cause traffic risks to the people visiting the pagoda; and mobilization of a large workforce may impose security risks;
- Tam Toa Parish where local parishioners worship at weekends and during religious festivals is located near Thong Nhat road which is the transport route of dredged materials and waste to Cau Cup landfill. Transport trucks will increase traffic risks to travelers along this road; dust, emissions, and noise generated by transport trucks will affect religious activities of the parishioners at weekends, and cause impacts on the overall landscape of the road as well the view of Tam Toa Parish.

Conclusions

Risk level: <u>LOW</u> and can be mitigated

13. Community Health and Safety

Risks of safety and health for the community near construction areas of Component 1 include:

- Increased traffic safety risks when roads and footpaths are narrowed for construction. Disturbed ground, open channels for pipe placement, materials piled at roadside may cause accidents to drivers, pedestrians or local communities. Aged people and young children are most vulnerable to increased traffic safety risks. The sections near schools such as Le Truc, Nguyen Van Linh, Phan Dinh Phung will be most risky at peak hours (early mornings, afternoons and lunch time) when trucks, excavators and cranes working on busy roads at a time with many students travelling.
- Operation of construction plant, temporary loadings and handling of construction materials including bulky construction materials such as large pre-cast pipes, concrete beams, long steel bars for bridges etc.
- During the demolition of the existing Cong Muoi bridge and reconstruction of the bridge, the local community needs to be properly informed of the disruption and danger and the site properly fenced and protected. Local people may enter the construction site by mistake

and accidents may occur.

- The relocation of the affected infrastructure including the electrical cables and poles and the existing drinking water pipeline at the Cong Muoi bridge would also cause safety risks to local community if the sites are not protected properly.
- Deep excavations at the pumping station construction areas and along pipe trenches, may be dangerous for pedestrians and drivers in the areas, especially children.
- Dust and emissions from construction sites and along the roads may affect people's health. Health impacts may include itchy, stiffing, and eye irritancy. However, the calculated volume of dust emitted at construction sites is small, thus, health risk to community is low.
- Construction of school toilets will impose significant safety risks to students if the sites are not properly managed.
- The storage and usage of electricity, gas, hazardous materials, etc. by the contractors may also pose safety risks to the public

Conclusions

Risk level: MEDIUM and can be mitigated

14. Safety and Occupational Health of Workers

Earthworks, loading and unloading materials, operation of construction plants such as excavators, cranes, trucks, welders, and concrete mixers all have potential accident risks or pollution affecting workers if there are no control measures.

The storage and usage of fuels such as power, gas, petrol contains accident risks related to electrical shock, fire, explosion, leakage etc., and pollution which will affect the health and safety of workers.

There are safety risks associated with working at construction sites with various types of materials and machines, equipment, and with many vehicles passing by. Other site risks include working at height while building the bridge, or working deep under the ground while excavating ditches, especially the pumping stations.

Camp conditions, availability of water supply, kitchen, sanitation facilities and drainage within and surrounding the camps will be important to the health of workers. If the camp or construction site is surrounded by vegetated ground, snakes and other harmful reptiles may enter the camps and attack the workers. This risk may be encountered at the construction site of PS No. 19.

In addition, weather factors need to be taken into account during construction such as high temperature in Dong Hoi city in the summer when the outdoor temperature may reach 40°C as during the construction phase of CCESP project, or storms that may occur very often from July to October that can also cause safety risks to the workers.

Conclusions

Risk level: MEDIUM and can be mitigated

3.3.1.3 Type-Specific Impacts of Component 1

Among the common construction impacts and risks discussed earlier in this chapter, some issues are more typical to one type of investment than the others. Therefore type-specific impacts are listed in Table 3-16 below:

Table 3.16: Type-Specific Impacts – Component 1

No.	Type of Investments	Typical Impacts
1	Pipeline installations	- Generation of excavated materials - Dust from ground disturbance and transportation - Traffic disturbance and increased traffic safety risks - Soil subsiding risks - Damages to powerlines when cranes load/unload bulky pipes - Disturbance to community's daily lives and businesses
2.	Construction of Pumping stations	- Safety for workers when entering/exiting and working in deep holes - Injury risks related to insects, needles, broken glass etc when disturbing abandoned vegetated areas - Soil subsidence risks related to deep excavation up to 6-9 m
2.	Construction of Outfalls	Not applicable due to Disturbed areas being quite small compared to the receptor, and the exact locations have not been identified.
3.	River dredging	- Reduced water quality related to dredging and disposal of dredged materials; river flow impeded - Safety for workers when working in the river - Worker's health and safety related to construction camps - Safety risks for the public related to the operation of construction plant
4.	Bridge demolition and reconstruction	- Affect existing power and water supply - Safety of workers when working in water and at height - Traffic disruption - Safety risk for the public - Noise from pile driving
5.	School toilet construction	- Noise and dust - Behaviors of workers - Safety of students and teachers

3.3.1.4 Site–Specific Impacts of Component 1

1. Construction of Drains, Manholes, Outfalls, and Pump Stations:

(i) Under construction and installation of drains, specific impacts are presented in Table 3.17 below:

Table 3.17: Site–specific Impacts of Drain Construction

No.	Road route	Works	Specific impacts
1	Ly Thai To Road	Sewer routes Nos.1, 2, 3, 5, 6: D200, L=1,971m, D300 L=1,027 m, D400, L= 671m; Sewer routes Nos. 1, 3, 3^A, 4, 5: D600, L=149m, D800, L=123m, D1000, L=1,626 m, D1500 L=249m Total length: 5,816Km Excavating depth: 1.2 – 4.3	- Traffic disturbance since the construction area occupies 4.5m of the road width; the remaining width of road is 7.5m, with long construction time, and long affected period; - Damages to existing water pipes and power line, disrupt water and power supply - Social disturbance in this populated area; - Dong Son Primary School is sensitive to gas emission, dust, noise and external appearance; - Increased traffic risks when the road passing the school and Con market;

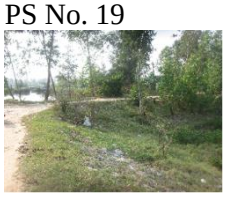
			- Deep excavation to 4.3m may cause land slide risk and damages to existing weak structures at road side.
2	Le Hong Phong Road	Drainage routes No.1, 2 D1.500, L= 275m D600, L= 97m Sewer route No.1: D400, L= 1898m Total length: 2,270 m Excavating depth: 1.2 – 2.2	- Traffic disturbance since the construction area occupies 4.5m of the road width; the remaining width of road is 4.5m, with long construction time, and long affected period; - Damages to existing water pipes and power line, disrupt water and power supply - Dong Son Primary School No. 1 is sensitive to gas emission, dust, noise and external appearance;
3	Ton That Tung (Nam Ly) Road	Sewer route No.9: D300, L=272m; D300, L=208m; Sewer route No.6: D600, L=120m, D800, L=125m Total length: 725m Excavating depth: 2.15 – 2.47	- Traffic disturbance since the construction area occupies 3.8m of the road width, the remaining width of road is 4.2m; - Damages to existing water pipes and power line, disrupt water and power supply – Social disturbance to residential HHs and shops along road sides; - Vietnam-Cuba Dong Hoi Hospital is sensitive to gas emission, dust, noise and external appearance;
4	Trung Truong Road	Drainage route No.6: D1,000, L= 147m, D1,500, L=157m Total length: 304m Excavating depth: 1.5 – 2m	- Traffic disturbance since the construction area occupies 4.5m of the road width, the remaining width of road is 1.5m wide;- - - Risks for traffic safety at intersections with cross roads, and temporary storage of big pipes; - Electric lines may be affected due to crane operations.
5	Ngo Gia Tu Road	Drainage route No.7: D800, L=88m Sewer route No.9 D300-L=495m Total length: 583m Excavating depth: 1.67 – 3.35m	- Traffic disturbance since the construction area occupies 3.8m of the road width, the remaining width of road is 2.2m. - Social disturbance to residential houses - The trees on road sides may be affected; - The deepest excavated area is 3.35m, there's a depression risk.
6	Huu Nghi Road	Drainage route No.8: D800, L= 132m Drainage route No.14: D1000, L= 562m Total length: 694m Excavating depth: 1.3 – 1.5m	- Traffic disturbance since the construction area occupies 3.8m of the road width, the remaining width of road is 18.2m; - Social disturbance to the popular area: The crowded residents, offices on road sides can be affected: DONRE, Fire Protection Department, Huu Nghi Hospital;
7	To Huu Road	Drainage route No.9: D800, L= 397m Excavating depth: 1.3 – 1.5m	- Traffic will be disturbed since the construction area occupies 3.8m of the road width, the remaining width of road is 8.2m - Disturbance or damages to the powerline

			- Traffic disturbance and safety risk in populated area and the Nam Ly bus station
8	Nguyen Van Linh Road	Drainage route No.10: Box culvert 2x2m, L=188m Excavating depth: 2.5m	- Traffic will be disturbed since the construction area occupies 3.8m of the road width, the remaining width of road is 11.2m Disturbance or damages to the existing water pipes
9	Le Truc Road	Drainage route No.11: D800, L=132m Excavating depth: 1.3m	- Traffic will be disturbed since the construction area occupies 3.5m of the road width; the remaining width of road is 3.7m Damages to existing water pipes, drainage and power line, disrupt water and power supply and drainage - Hoa Hong Kindergarten and City PPC are sensitive receptors
10	Nguyen Huu Canh Road	Drainage route No.12: D800, L=160m Excavating depth: 1.3m	Damages to existing water pipes, drainage and power line, disrupt water and power supply and drainage
11	Sub-area 4, Dong Phu	Drainage route No.13: D1500, L=268m Excavating depth: 2m	Overclearance or disturbance to the of existing vegetation cover
12	Thong Nhat Road Lane (Duc Ninh Dong)	Drainage route No.15, D600, L=226m Excavating depth: 1.3m	- Traffic disturbance and increased traffic safety risk as the required construction area is 3.1m wide and the remained part of road is 2.7m wide; This road is on transportation route of materials/waste - Few residents on roadsides, the impacts on domestic activities is small
13	Phan Dinh Phung Road	Drainage routes Nos.16, 17, 18, 22 and 23: D800, L=134m, D1000, L=1.381 m, D1500, L=675m. Total length: 2,459m Excavating depth: 1.3 – 2 m	- Disturbance to roadsides HH and businesses; - The receptors sensitive to dust, emissions, noise are students of Bac Ly Secondary School No.1, Bac Ly Primary School No.1 The construction route is long, level of impact on the traffic, society, and sensitive receptors will be higher than other routes.
14	Hoang Dieu (Nam Ly) Road	Drainage route No.19: D800, L=299m; D1.000, L=77m Drainage route No.20: D800, L=288m Total length: 664m Excavating depth: 1.3 – 2 m	- Traffic disturbance since the required construction width is 4.5 m and the remained part of road is 3.5m; - Disturbance to roadside HH and business ; - Electric lines can be affected due to crane operations
15	Le Loi Road	Drainage routes Nos. 21, 25: D600: L=167m D800: L=99m D600-L=173m D600: L=167m D800: L=99m Total length: 792m Excavating depth: 1.2 – 1.5 m	- Traffic disturbance since the required construction area is 3.8m wide and the remained part of road is 16.2m wide; - Disturbance to roadsides HH and business ; - Dong Hoi General Hospital and Dai Giac Pagoda are sensitive receptors affected by dust, noise and emissions. Soil subsidence as big pipes are installed
16	TK9 Road, Bac Ly	Drainage route No. 24: D1000, L= 453m D1500, L= 436m Sewer route No.14:	- Traffic is disordered since the construction area occupies 4.5 m of the road width, the remaining width of road is 1.5m

		D300, L= 475m Total length: 1,364 m Excavating depth: 1.45 – 3 m	- Disturbance to local residents and many shops along road sides will be affected; - Risks for electric lines - Depression risk is potential due to 3m deep excavation Cultural House is sensitive receptor
17	Truong Phap Road	Sewer route No. 12: D150, L= 499m Excavating depth: 1.2m	- Hotels, restaurants serving tourists and local people (high season from March to August) will be significantly affected; - The beauty of Nhat Le Beach will be affected.
18	Hoang Sam Road	Sewer routes Nos. 13, 15, 23 and 24: D150, L=432m; D200, L=346m D300, L=596m D400, L=229m Total length: 1,603 m Excavating depth: 1.2 – 3.46m	- Traffic will be affected since the construction area occupies 3.4 m of the road width, the remaining width of road is 3.6m; - Disturbance to populated area
19	Dang Thai Than Extended Road	Sewer route No. 16: D300, L= 558m Sewer route No. 17: D300, L= 219m Total length: 777 m Excavating depth: 1.2 – 3.1m	- Traffic will be affected since the construction area occupies 3.4 m of the road width, the remaining width of road is 1.6m Damages to existing power supply system
20	Vu Trong Phung Road	Sewer route No. 20: D300, L= 334m Excavating depth: 1.8 – 2.4 m	- Traffic will be affected since the construction area occupies 3.4 m of the road width, the remaining width of road is 1.6m - Disturbance to populated area
21	Le Duc Tri Road	Sewer routes Nos. 25, 26 and 27: D300, L = 1.358m Excavating depth: 1.5 – 2.6 m	- Traffic will be affected since the construction area occupies 3.4 m of the road width, the remaining width of road is 1.6m - Disturbance or damages to existing power supply system - Local people's lives will be affected.

Table 3.18: Site–specific Impacts of Pumping Stations (PS)

Pumping station	Status	Specific Impacts/issues
PS No. 15 	- There is an existing two-lane, 12-14m wide asphalt road; - The area is densely populated with many shops and offices;	- Traffic safety risks - Safety risk to the public related to deep excavation - Urban landscape
PS No. 16 	- On vacant land, 4m from Ly Thai To road, located in Residential Area No. 2, Bac Nghia ward	- Safety risks for the workers when disturbing the bush (insects, broken glass, needles etc.)

Pumping station	Status	Specific Impacts/issues
PS No. 17 	- The area is filled with 1m-high spoil tip, the nearest house is 4m on the other side of the road - It borders a 4m-wide asphalt road to the South. - Electrical wires and poles nearby	- Traffic safety risks - Damages to the electrical wires above - Urban landscape - Community safety risks
PS No. 18 	- The site is flat, the nearest house is 4m over the road in the West. - It borders with a 12-14m asphalt road in the South - Electrical wires and poles nearby	- Damages to the electrical wires above - Community safety risks
PS No. 19 	- The land is unused, there are no residents nearby.	- Safety risks for the workers when disturbing the bush (insects, broken glass, needles etc.)

2. Dredging and Embankment Lining of Cau Rao River, and Construction of Cong Muoi Bridge

The potential impacts related to the works in the Cau Rao River and Cong Muoi Bridge have been discussed in detail in previous subsections and summarized below:

- The construction of cofferdams for river dredging would block one river section and affect water quality and aquatic lives;
- Seven sullages may be affected by river dredging;
- Generation of 13,214 m^3 of dredged materials with salinity at 10^o/oo . Land is needed for temporary and final disposal;
- Dredged materials and water drained from the material may cause soil water pollution, and cause harm or kill terrestrial flora including existing trees. Temporary disposal of dredged materials would disturb the existing vegetation cover at riverside;
- two 24KV electric poles and a water pipe will be affected by the demolition and reconstruction of the Cong Muoi bridge. There will be a safety risk for the public during the demolition of the existing bridge and the construction of the new bridge;
- Construction of Cong Muoi Bridge during 12 months will interrupt the traffic on Le Loi Road at Cong Muoi Bridge section. An alternative bridge is available for crossing the river;
- There are safety risks for the workers when working on water surface or on high bridge poles;
- Dai Giac is the sensitive receptor at the Cau Rao river construction site.

3.3.1.5. Operation Phase

1. Capacity of Receptors in Receiving Stormwater from Outfalls

- Stormwater: When the proposed stormwater drains are put into operation, stormwater will be collected and discharged into the existing reservoirs and canals through six main outfalls. Capacity of the receiving bodies to store additional stormwater is calculated in detail as follows:

+ Calculated rain intensity:

$$q = \frac{A.(1+ClgP)}{(t+b)^n} \quad (l/s\text{-}ha)$$

In which:

q is the intensity of the rain. (l/s-ha)

t is the time of rain. Take t = 180 minutes.

A, b, n, P coefficients estimated for Quang Binh based on data from Quang Tri province in accordance with the standard TCXDVN-7957:2008 as follows:

$$\begin{cases} A = 2230 \\ b = 15 \\ C = 0.48 \\ n = 0.62 \end{cases}$$

Take P = 2 (years)

-->Maximum calculated rain intensity in 03 hours is q = 220,06 l/s-ha

+ Flow rates calculated for the balancing reservoirs:

Q=q.C.F. In which:

Q: Calculated flow (l/s)

q: Calculated rain intensity

F: Catchment area (ha).

C: Cover surface coefficient with P calculated = 2 years.

+ Volume of balancing reservoir W (m^3)

The regulating volume W (m^3) is determined by using the chart showing the relationship between incoming and outgoing flow rates of the reservoir (using average and maximum water levels). Balancing volume can be calculated applying the limited intensity method following formula:

$$W = Qn - Qr$$

In which:

Qn - Calculated discharge of stormwater flowing into the reservoir (m3/s); across the whole basin of drains discharged into the reservoir during rain of 180 minutes.

Qr - Calculated discharge of stormwater flowing out of the reservoir (m3/s); across the drain outfall section.

Calculation results of the balancing capacity of reservoirs are presented in Table 3.19 as follows:

Table 3.19: Discharge Adaption of Six Outfalls

No.	Region/Site	Area (ha)		Drain		Volume of Reservoir (m^3)		Assessment
		Basin	Reservoir	Dimension (m)	Discharge rate (m^3)	Discharge rate through outfalls	Maximum discharge capacity	
1	Dong Son Lake CX1, CX2	32.70	2.52	0.6 x 0.6	3,888	23,313	25,200	satisfactory
2	Khe Duyen Lake CX4, CX6	180.25	24.72	5 x 1.75	94,500	55,437	370,800	satisfactory
3	West Huu Nghi LakeCX3, CX5	64.65	0.89	2x 1.5 x 1.5	48,600	5,178	10,680	satisfactory

Thus, with rainfall q ≤ 220.06 l/s-ha in less than three hours, the receiving reservoirs will be capable to store and absorb the additional incoming flow from the proposed outfalls. In case of heavier rains, flooding will occur.

The existing elevations at the bottom of the receptors are at +1.2m to +3.2m absl. With diurnal tides, sea level ranges between +0.40m to +0.92m. The existing ground level of the reservoir bed is higher than sea level even at high tides. According to one of the built climate change scenarios, the average sea level in Dong Hoi City may rise 65cm by 2050, 75cm by 2070 and could rise 1 meter by 2100. With the existing altitude of road system around the reservoir, under the impact of sea level rise due to climate change, the reservoirs are safe at least until 2100.

2. The Duc Ninh Wastewater Treatment Plant

The sewer system, when completed, will result in the influent to the Duc Ninh wastewater treatment plant increasing from 6,200 to 12,811 cmd. In addition, 1,990 cmd of wastewater from Bao Ninh Peninsula will also be collected and transmitted to Duc Ninh WWTP, increasing the total influent to the Duc Ninh WWTP to 14,800 cmd. A full Environmental Impact Assessment Report has been prepared for the Duc Ninh WWTP and approved by the World Bank in 2010. The WWTP has been in operation since mid 2014. The potential impacts and pollution control performance of the plant during the project operation phase are discussed briefly below:

a. Air Quality Management

Odor generated from the plant's pretreatment tanks and aeration basin is mainly NH_3, H_2S and decomposed organic matter in pretreatment tank (pumping stations, garbage screens, sand sedimentation tanks, septic tanks). Odor-generated gases are well managed by a collection system installed within the pretreatment tank and aeration basin as shown in the picture below:

Hood system for gas treatment systems

Aeration tank and hood covered

Figure 3.7: Odor Treatment System of Duc Ninh WWTP

The collected gases are treated in a specialized odor reduction tower. Also, the WWTP is 1200 m from the nearest residential house thus the residual impacts of odor from the WWTP are negligible.

b. Treated Wastewater

The treated wastewater from Duc Ninh WWTP is discharged to Le Ky River.

To evaluate the capacity of the receptor to receive the treated wastewater from Duc Ninh WWTP, the methods provided in Circular No.02/2009/BTNMT[12] have been applied:

Step 1: Preliminary assessment of the receptor, the Le Ky river

- Water in Le Ky river is not a source of domestic water supply.
- In Le Ky River, water does not have black color or a bad smell.
- In Le Ky River, there are no indications that the lives of aquatic organisms are being threatened, and mass mortalities of aquatic species have not been reported. No algal blooming is reported.
- There are no known documents or data reporting community illnesses caused by exposure to river water.

Step 2: Detailed assessment of receptor's wastewater receiving capacity to receive treated wastewater based on specific parameters:

Data for assessing the wastewater receiving capacity of Le Ky River are as follows:

- **Q_s** (m^3/s) is the instantaneous flow discharge of Le Ky river, measured $Q_s \sim 3.1$ m^3/s (in the driest month).

[12] dated 19/3/2009 by the Ministry of Natural Resources and Environment

- **Q_t**(m^3/s) is the maximum wastewater discharge Q_t= 14,800 cmd ~ **Q_t** = 0.167m^3/s

- **C_{tc}**(mg/L) is the limit value of pollutant concentration under the national technical regulation on surface water quality, QCVN08: 2015/BTNMT level B1.

- **C_t**(mg/L) is the maximum concentration value of pollutants in wastewater after treatment in Duc Ninh WWTP

- **C_s**(mg/L) is the maximum concentration value of pollutants in Le Ky River.

- Safety factor **F_s**: follow the instructions in Circular 02/2009/BTNMT, safety factor F_s has a value range of $0.3 < F_s < 0.7$. Calculating the self-cleaning ability of Le Ky River, using a safety factor $F_s = 0.4$.

Concentrations of some typical pollutants in wastewater generated from Duc Ninh WWTP and Le Ky River are as follows:

Table 3.20: Concentrations of Some Typical Pollutants in Treated Wastewater from Duc Ninh WWTP and Le Ky River

Parameter	Concentration (mg/l)	
	Le Ky River	Wastewater from Duc Ninh WWTP
BOD_5	1	19.1
COD	5	28
Phosphorous (in P)	0.03	0.68
Coliform	200	2,900
Nitrate	0.5	0.7
Nitrite	0.022	0.209
TSS	5	26
Ammonium	0.05	3

(Supposed to select the safety factor of 0.4)

Le Ky River has been used for irrigation and drainage, and aquaculture purposes, thus permissible values of pollutants in the water source should be applied following Column B1-QCVN 08:2015/BTNMT.

Table 3.21: Allowable Values of Pollutants in Water Sources

Parameter	BOD_5	COD	Phosphorous	Coliform	Nitrate	Nitrite	TSS	Ammonium
Limit value = C_{tc} (mg/l)	15	30	0.3	7,500	10	0.04	50	0.5

Applicable formula to calculate the maximum pollutant load: **$L_{td} = (Q_s + Q_t)* C_{tc}*86.4$**
In which:

+ L_{td} (kg/day): Maximum pollutant load of the water source for the pollutant in question;
+ Q_s (m^3/s): Minimum instantaneous flow discharge in river section under evaluation before receiving wastewater;
+ Q_t(m^3/s): Maximum wastewater discharge;
+ C_{tc}(mg/l): Limit values of concentration of the pollutant in question;
+ 86.4: Secondary unit conversion factor from (m^3/s)*(mg/l) into (kg/day).

We have the maximum pollution load for Le Ky River to receive pollutants as follows, respectively:

Table 3.22: Receivable Maximum Pollutant Load by Le Ky River

Parameter	BOD_5	COD	Phosphorous	Coliform	Nitrate	Nitrite	TSS	Ammonium
$(Q_s + Q_t)$ (m^3/s)	3.267	3.267	3.267	3.267	3.267	3.267	3.267	3.267
C_{tc}(mg/l)	15	30	0.3	7,500	10	0.04	50	0.5
L_{td} (kg/day)	4,233.41	8,466.81	84.67	2,116,702.50	2,822.27	11.29	14,111.35	141.11

Apply formula to calculate the available pollutant load in the receiving water source:

$$L_n = Q_s * C_s * 86.4$$

In which:

+ L_n (kg/day): The available pollutant load in the receiving water source;
+ Qs (m3/s): Minimum instantaneous flow discharge in river section under evaluation before receiving wastewater;
+ Cs (mg/l): Maximum concentration value of pollutants in the water source before receiving wastewater;
+ 86.4: Secondary unit conversion factor from (m^3/s)*(mg/l) into (kg/day).

We have the load of pollutants in Le Ky as follows:

Table 3.23: Load of Pollutants in Le Ky River

Parameter	BOD_5	COD	Phosphorous	Coliform	Nitrate	Nitrite	TSS	Ammonium
Q_s (m^3/s)	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
C_s (mg/l)	1	5	0.03	380	0.7	0.022	5	0.06
L_n (kg/day)	267.8	1,339.2	8.0	101,779.2	187.5	5.9	1,339.2	16.1

Apply formula to calculate the pollutant load from waste sources to receiving sources:

$$L_t = Q_t * C_t * 86.4$$

In which:

+ L_t (kg/day): Pollutant load in the waste source;
+ Q_t (m^3/s): Maximum wastewater discharge;
+ C_t (mg/l): Maximum concentration value of pollutants in wastewater;
+ 86.4: Secondary unit conversion factor from (m^3/s)*(mg/l) into (kg/day).

Load of those pollutants from the WWTP to Le Ly River is as follows, respectively:

Table 3.24: Load of Pollutants Discharged from WWTP into Le Ky River

Parameter	BOD_5	COD	Phosphorous	Coliform	Nitrate	Nitrite	TSS	Ammonium
Q_t (m^3/s)	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
C_t (mg/l)	19.1	28	0.68	2,900	0.7	0.209	26	3
L_t (kg/day)	275.59	404.01	9.81	41843.52	10.10	3.02	375.15	43.29

Apply formula to calculate the ability to receive pollutant load of the water source for a number of specific pollutants: $L_{tn} = (L_{td} – L_n – L_t) * Fs$

In which:

+ L_{tn} (kg/day): Capacity to receive pollutant load of the water source;
+ L_{td} (kg/day): Maximum pollutant load of the water source for the pollutant in question;
+ L_n (kg/day): The available pollutant load in the receiving water source;
+ L_t (kg/day): Pollutant load in the waste source;
+ Fs : Safety factor, take 0.4

Le Ky River's capacity to receive wastewater from WWT station for specific pollutants is as follows, respectively:

Table 3.25: Receiving Capacity of Le Ky River

Parameter	BOD_5	COD	Phosphorous	Coliform	Nitrate	Nitrite	TSS	Ammonium
L_{td} (kg/day)	4,233.41	8,466.81	84.67	2,116,702.50	2,822.27	11.29	14,111.35	141.11
L_n (kg/day)	267.84	1339.2	8.0352	101779.2	187.488	5.89248	1339.2	16.0704
L_t (kg/day)	275.59	404.01	9.81	41843.52	10.10	3.02	375.15	43.29
L_{tn} (kg/day)	1,475.99	2,689.44	26.73	789,231.91	1,049.87	0.95	4,958.80	32.70

Conclusion: With the maximum waste discharge rate at 14,800 cmd from the Duc Ninh WWTP, the Le Ky River is capable to receive BOD_5, COD, Phosphorous and Coliform, TSS, Nitrate, Nitrite, Ammonium.

Figure 3.8: Location and Outlet of Duc Ninh WWTP

c. Solid Waste Management

The amount of solid waste generated during the operation of Duc Ninh WWTP is summarized as follows:

Table 3.26: Solid Waste Generated in Duc Ninh WWTP

No.	Type of wastes	Source	Amount of generated wastes
1	Domestic wastes	Garbage screen	40 kg/month
		Biological lagoons	73.2 kg/month
		Administrative house	15kg/month

(Operation report 2015 of Duc Ninh WWTP)

Waste and sludge are collected and dumped together with domestic waste collection system of the city.

Biomass of sludge generated in the treatment tanks is proportional to BOD_5, at ratio of 0.25 kg/kg BOD_5 (according Syllabus of Urban Wastewater Treatment by Dr. Tran Duc Ha - Technical Scientific Publisher in 2007). With BOD_5 concentration of 220mg/l, influent at rate 14,480 cmd, and treatment efficiency of 90%, the total amount of dry sludge generated is 0.25 kg/kg BOD x 220 mg/liter x 14,800 cmd x 90% = 73.2 kg/day (equivalent to 26.7 tonnes/year).

Sludge is initially stored in the facultative and maturation ponds. After 5- 7 years , the ponds will be desludged and pumped to drying beds for natural drying. The final wet sludge product has a moisture of 52%, so the total amount of wet sludge will be:

26.7 tonnes x 52/48 =28.9 tonnes/year

Dried sludge will in the future be taken from the drying beds and reused partially for trees in the plant campus and in neighboring areas. The balance will be disposed of at Ly Trach landfill by Quang Binh URENCO.

This solid waste will be managed so as not to contaminate the environment, particularly the impact on the health of operating workers in the plant.

d. Impact on Water Quality and Flow Regime of Le Ky River

Treated wastewater of Duc Ninh WWTP satisfies the national technical standard for surface water quality QCVN 08:2015/BTNMT level B1, and Le Ky River can accept and dilute the treated wastewater. Hence, the impact to water quality of Le Ky River is minor.

During operation phase, the total wastewater load is estimated at 14,800 cmd or about 0.167 m^3/s. According to reference [10], flow discharge of Le Ky River is $630m^3/s$ in the flood season and $3.1m^3/s$ in the dry season. Therefore, even in the dry season, the flow from the WWTP only contributes 5% to the flow rate of the Le Ky river, which is quite small. In flood season, the contribution of the WWTP to the flow in the Le Ky river is negligible (0.27%). The project will not lead to any significant changes in the natural discharge and flow velocity of the river.

d. Impact on aquatic species in the Le Ky River

As indicated in Chapter 2, there are some fish species of economic value in the Le Ky River and there are no known rare or endangered aquatic species in the project area. The outflow from the Duc Ninh WWTP does not cause major or abrupt changes in water quality or flow rate in the Le Ky river, thus the potential impact of Duc Ninh WWTP on the biological settings in the Le key river is negligible.

e. Risks of Incidents in Duc Ninh WWTP

During operation of the WWTP, the following risks may occur: pipelines of the sewerage and drainage systems get clogged, cracked, or broken; aeration pipes may get damaged; power failure; plant outages, flooding incidents, and treatment efficiency achieves <50%.

When sewage or aeration pipes get broken this leads to sewage leakage. Wastewater discharging to the soil may cause localized pollution. Stagnant wastewater can cause diseases such as cholera, dysentery, typhoid to people in area of incidents, and can affect the natural landscape.

Even when the treatment efficiency of Duc Ninh WWTP is <50%, concentration of pollutants in wastewater flowing into Le Ky River still exceeds the QCVN 08: 2015/BTNMT (National Technical Regulation on surface water quality), load of pollutants are smaller than receiving capacity of Le Ky River, presented in Table 3.27 below::

Table 3.27: Load of Pollutants under Treatment Efficiency

Parameter	BOD_5	Phosphorous	Nitrate	TSS
L_{td} (kg/day)	4,233.41	84.67	2,822.27	14,111
L_n (treatment efficiency =0%)	865.72	28.85	360.71	19,358
L_t (treatment efficiency =50%)	432.86	14.42	180.35	1,111
L_{tn} (treatment efficiency =30%)	606.00	20.19	252.5	4,958

This incident will cause water quality degradation in Le Ky River and may affect local surface aquatic species. This incident will be fixed when the treatment efficiency of the plant is restored to above 90%.

Power failure will stop the operation of the plant, wastewater will not be treated and the aeration system will cease. This will affect on the treatment efficiency of the plant. Untreated wastewater discharged into Le Ky River will first cause localized pollution at discharge points before the polluted water can disperse further. However, the plant has been equipped with a 250KVA stand-by generator to maintain plant operation, especially pumping and aeration areas, so the risk of this incident is small.

Topographically, Duc Ninh WWTP has an elevation of +3.2 to 3.5m above sea level and is 0.5m higher than the surrounding area so flooding is unlikely to occur.

f. Plant Operation Performance

Duc Ninh WWTP was put into operation in July 2014. Its operation is stable and an environmental monitoring program has been conducted periodically. The results are as follows:

Results of air environmental monitoring summarized in Table 2.4 (Chapter 2) show that the pollutant content in air in the plant and its surroundings does not go beyond the QCVN 05: 2013/BTNMT.

Results of pre- and treated wastewater monitoring summarized in Table 2.9 (Chapter 2) show that the treated wastewater satisfies relevant standards.

3. School and Public Toilets

The main concerns during operation of school toilets are odor, hygienic conditions and users' safety. The generated wastewater from school toilets is summarized in Table 3.28 below:

Table 3.28: Wastewater from School Toilets

No.	School name	Number of students (by 2020)	Generated wastewater (cmd)
1	Dong Son Secondary No.1	560	8.40
2	Duc Ninh Primary School	617	9.26
3	Bac Nghia Secondary School	625	9.38
4	Duc Ninh Dong High School	615	9.23
5	Duc Ninh Secondary School	615	9.23
6	Hai Thanh Secondary School	522	7.83
7	Loc Ninh Secondary School	615	9.23
8	Quang Phu Secondary School	362	5.43
9	Bac Ly Secondary School No.2	625	9.38
10	Nam Ly Secondary School No.2	600	9.00
11	Nam Ly Secondary School No.1	600	9.00

(Note: The norm of water supply per capita is 80-100l/person/day; as students stay at school for only 6-8h/day without eating and living at schools, the amount of water for their hygienic activities is calculated at 15l/person/day on average)

Wastewater is not concentrated in place but at 11 schools. The toilets have septic tanks before discharging into general culverts or receiving sources, hence the degree of pollution and its potential of spreading to the environment is significantly reduced.

The amount of wastewater generated from five public toilets is small, and the wastewater been treated before being discharged into the city drainage system. Therefore, the wastewater generated to the surface water environment from this source is considered as negligible.

School and public toilets are used by many people, exposed frequency is high, thus the impacts on appearance of works is significant. Public toilets under CCESP is managed by the Beach Management Unit. Public toilets have been highly efficient and guaranteed environmental external appearance. Six public toilets under CCESP will also be handed over to the Beach Management Unit for management.

Since it is difficult to keep public and school toilets clean with accumulated dirt, bad smell, harmful bacteria and viruses affecting health of users, it is necessary to apply mitigation measures right from the project design for increased good appearance and environmental friendliness.

Conclusions

Impact level: MEDIUM, can be mitigated.

3.3.2 Negative Impact Assessment for Component 2

Component 2 includes the following: (i) building a 1.44km long road from Nhat Le II Bridge to the City bypass; (ii) building two bridges: Le Ky Bridge 212m long, with six spans, and 30m wide and Tay Bridge: 24m long, one span, 21m wide. The two bridges are on the same alignment as the road.

3.3.2.1. Pre-construction Phase

During the pre-construction phase, ground clearance is required, and there will be risks of excavating bombs and landmines remaining from the war.

1. Land Acquisition and Site Clearance

The total area of permanent land acquisition is 101,413m^2 including 25,826.4m^2 of rice cultivating land (25.5%); 52,710.2m^2 (51.9%) of aquaculture lakes; 22,876.4m^2 (22.56%) of roads and irrigation canals of 2 wards - Duc Ninh Dong and Phu Hai and Duc Ninh Commune. Details of affected land in wards are presented in Table 3.29 below:

Table 3.29: Land Loss Areas and Structures on Land of Component 2

No.	Ward/Commune	Annual crop land (m^2)	Aquaculture land (m^2)	Public land (Roads, irrigation canals) (m^2)	Total affected area (m^2)
1	Duc Ninh Dong	17,933.00	16,729.00		
2	Phu Hai	7,753.40	14,681.20		
3	Duc Ninh	140.00	21,300.00	22,876.40	
Total		**25,826.40**	**52,710.20**	**22,876.40**	**101,413.00**

Source: 2016 loss survey data.

There are 43/43 seriously affected HHs with 243 affected persons. Among 43 AHs, there are 16 sensitive HHs, including 15 poor HHs, and two HHs under preferential policies. None of the HHs belong to ethnic minority groups.

Table 3.30: Affected HHs during Component 2 Construction

Ward/ Commune	Total affected HHs	Total persons	Total population	
			Male	Female
Duc Ninh Dong	29	152	78	74
Phu Hai	12	67	37	30
Duc Ninh	02	15	8	7
Total	**43**	**234**	**123**	**111**

Sources: Socio-economic survey data 2016.

90% of the 234 affected people are working in agriculture (rice cultivation and aquaculture), and as a result, the number of people whose livelihoods are lost permanently is 210 people.

Land acquisition and ground clearance on a total area of 101,413 m^2 will cause loss of trees and agricultural products as presented in Table 3.31 below:

Table 3.31: Trees and Plants Affected by Component 2

Ward, Commune	Eucalyptus, Casuarina, Acacia, Melaleuca (Trees)	Bamboo, plum tree, rattan... (bushes)	Lecythidaceae (trees)	Dalbergia Tonkinensis Prain (trees)	Elephant grass (m^2)	Citronella, chilly (bushes)
Phu Hai	120	10	0	0	0	140
Duc Ninh	**62**	**0**	**10**	**5**	**100**	**0**
	182	**20**	**15**	**5**	**100**	**140**

(Report: Resettlement Action Plan of the Project)

In addition to the above mentioned trees, there are some affected agricultural industries such as rice cultivation and fisheries. Loss of agricultural industry of the people in Phu Hai ward is the highest. This loss will be adequately compensated according to the project Resettlement Action Plan.

Land acquisition will affect temporary buildings, aquaculture ponds, sluices for water, power lines and power supply of HHs along. Loss of houses and infrastructure under Component 2 is summarized in Table 3.32 below:

Table 3.32: Infrastructural Loss of Component 2

No.	Object of loss	Unit	Quantity
1	Temporary houses	m^2	500.0
2	Excavated fishery pond of >1.5m deep	m^2	59,255.2
3	Power lines	Km	3
4	Power supply	pcs	30.0
5	Culverts	pcs	3

(Report: Resettlement Action Plan of the Project)

Farmer HHs whose land is acquired, especially seriously affected HHs will have livelihoods and income affected. Dong Hoi subproject has prepared a Resettlement Action Plan for the management of impacts related to land acquisition and ground clearance.

2. Risks of UXO Accidents

Quang Binh is a province that was most affected by bombing and mines during the war. If any UXO is found or excavated at the site, it would pose serious danger and accident risk to the workers and other project resources.

Conclusions

This risk is assessed as SIGNIFICANT but can be mitigated.

3.3.2.2. Construction Phase

The main construction activities of Component 2 will consist of: preparation of construction sites, site-office, camps, temporary material parking areas, and mobilizing of workers and construction plants to the site; removal of top soil; construction of road base, compaction, installation of equipment, asphalt works; drilling, pile driving, construction of bridges, installation of power, drainage, sewers and water supply systems, and greenery and lighting provision.

Sources and impacted objects during construction of Component 2 are summarized in Table 3.33 below:

Table 3.33: Impact Sources and Levels during Component 2 Construction

No.	Impact/Issues	Impact	Object/ Area of influence	Level of impact	Duration
1	Dust, emissions, noise, vibration	- Dust generated from transportation, loading and unloading, temporary gathering of materials for building such as soil, sand, stone, cement and waste, or generated in the course of construction, especially earthworks - Gas emission from cars, trucks and construction plants such as excavators, cranes - Noise from construction plants, dump rocks down operations yard temporary location and noise while piling bridge construction - Vibration from piling driving during bridge construction.	- Workers at the site.	Medium	Short
2	Wastewater generation	- Stormwater runoff through construction areas. - - Wastewater from camps - Construction wastewater from washing of vehicles, plants, and construction tools and construction material preparation.	The surface water source surrounding the construction site, particularly the the most serious is Le Ky River, the existing aquaculture ponds and paddy fields	Medium	Short
3	Solid waste	- Top soil removed from rice field along the alignment - Solid waste from works camp, 21kg / day (11.1 tonnes / 24 months) - Small quantity of hazardous waste:	Construction site, Le Ky River water, aquaculture ponds, paddy fields	Medium	Long
4	Water quality (surface water)	- - Surface runoff from the construction site to the Le Ky river and the irrigation canals . - Wastewater from workers camps. - Wastewater from washing vehicles, plants.	water quality reduction in Le Ky River and the irrigation canals Paddy fields	Medium	Short
5	Biological Impacts	- Cut down 460 trees (eucalyptus, bamboo, acacia, casuarina, melaleuca), disturb and 200m2 of grass cover in front of Phu Hai Ward Cemetery.	- Terrestrial agricultural ecosystems in the area of road,	Low	Short

		2.6 ha of agricultural land and 5.2 ha of aquaculture pons is acquired for road construction Risk of mimosa pigra, an invasive plant, is spread into the construction area and affect the remaining agriculture land; - Aquatic species within an area of 200-300 m2 around abutments and piers construction will be affected	bridge construction - Localised aquatic species in Le Ky River		
6	Urban Landscape	Loss of vegetation cover, Lost of trees and canopy along the road alignment. - Impacts on the landscape Phu Hai Ward Cemetery as 200m2 at the gate area is temporarily used for construction purposes. - Dust incurred from material transport routes has aesthetical impacts on the roads	Construction areas and transport routes	Low	Short
7	Erosion and landslide risks	Erosion and landslide risk on slopes 2-3m high.	Irrigation canals, paddy fields, aquaculture ponds	Low	Short
8	Flooding, sedimentation, erosion	The road is 2-3m higher than the existing ground level may function as an embankment blocking drainage between the two sides of the road Construction materials and wastes falling into canals and rivers causing sedimentation Erosion potentials at unlevelled disturbed ground and granular materials dumps	Irrigation canals, paddy fields, aquaculture ponds Le Ky river Along the road alignment, At temporary storage and disposal areas	Mediu m	Short
9	Traffic disturbance	Traffic disturbance and increased traffic safety risks along the transportation routes of materials and waste, especially at the intersections at the two ends of the alignment	Quang Trung road and Highway 1	Mediu m	Short
10	Disturb or damage existing infrastructures, public services	- Existing irrigation canals, water intakes etc. along the alignment would be affected	Irrigation culverts and canals	Low	Short

11	Social impacts	- 43 HH with 210 people affected by land acquisition - social disturbance related to the mobilization of the workers to the sites - Accessibility to existing paddy field and other agricultural land at the two sides of the road alignment may be disturbed or interrupted;	43 HHs affected by land acquisition HHs having agricultural land along the road alignment not acquired and can continue cultivation	Mediu m	Short
12	Impacts on cultural, historical, and religious works	Dust will be released from construction materials stored in front of Phu Hai Ward Cemetery in south-easterly wind which is the main wind, affecting landscape of the cemetery	Phu Hai Ward Cemetery	Low	Short
13	Community Health and safety	dust, exhaust fumes affect farmers when working on the fields Safety risks related to construction activities, operation of construction plants, temporary loading of construction materials and wastes, use of electricity and gases and other hazardous substances	People around construction sites	Low	Short
14	Health and safety of workers	Safety risks while working in the construction site such as building abutment 5-5.5m above the water surface or under water; Inadequate accommodation conditions including water supply, sanitation facilities would pose health risks to the workers Health risk of workers involved in drinking or prostitution while working in the project	Construction workers at site	Low	Short

These impacts are specifically analyzed below:

1. Air Pollution

Air quality will be affected during the construction process by dust, emissions, noise, and vibration. The air pollution sources include:(i) dust generated from transportation, loading and unloading, temporary storage of construction materials such as soil, sand, stone, cement and waste, particularly excavated materials ; (ii) gas emissions from cars and construction plants (iii) pile driving noise when the bridge is under construction; (vi) vibration caused by pile driving for bridge construction.

Each type of impact related to air quality is analyzed and assessed below:

(i) Dust generation

+ Dust generated from temporary disposal of top soil

The total volume of soil excavated in Component 2 is 72,040 m^3, equivalent to 100,856 tonnes. In which 72,040 m^3 (100,856 m^3 tonnes) will be reused for back filling and tree planting.

Pollution coefficient E = 0.00299 (kg/ton) (calculated in section 3.3.1.1). The total dust emission is calculated: 302 kg, while ground clearance lasts six months, there are about 2kg/day from excavation activities. There are no houses along the road alignment, therefore dust from construction site would mostly affect workers, agricultural land and the farmers working there. So the impact can be considered as minor.

+ Dust generated from the operation of transport facilities

As all of the top soil will be reused at the construction site, and there are only vehicles carrying materials from the borrow pits and quarries to the construction site. The volume of soil, rock, sand and gravel have been used for air quality assessment under Component 1.

According to the assessment, the amount of dust generated by transportation of materials under Component 1 is small and does not impact much on the environment and people on the road sides. However, dust mitigation measures are still proposed in Chapter 5.

(ii) Air pollution caused by gas emission

- ***Emissions from transport vehicles***

When calculating the gas emission caused by the transportation process, emission from vehicles is shown in Table 3.3 and Table 3.4.

The calculated results show that the emissions generated during transport of waste and materials is similar to other dust generated sources, and is negligible.

- ***Emissions from construction machinery***

The emissions generated from construction machinery during road and bridge construction are calculated as follows:

The main construction equipment used in Component 2 is given in **Table 1.6** – Construction plants.

The following discharge coefficient is used for 01 liter of diesel (Source: US.EPA Locomotive Emissions Standard, Regulatory Support Document, April, 1998): HC - 2,83 g/l; CO - 7,25 g/l; Nox - 66,0 g/l; PM10 - 1,80 g/l. Fuel consumption level of the truck is taken as stipulated by Circular No. 06/2010/TT-BXD dated 26/5/2010 of the Ministry of Construction.

Emissions from construction equipment is assessed for the exhaust system and fuel consumption of the device. The evaluated data are given in Table 3.34.

Table 3.34: Total Emissions in One Production Shift

Plant	Fuel (liter/shift)	Total discharge/shift (g)			
		HC	CO	NOx	PM10
Bulldozer 110 CV	46.20	131	335	3048	83
Compactor 25T	54.60	155	396	3602	98
Roller 10T	26.40	75	191	1742	47
Scatter 130-140 CV	50.40	143	365	3325	91
Asphalt sprayer	45.90	130	333	3028	83
Compressor 600 m^3/h	38.40	109	278	2534	69
Excavator 1.65m^3	75.24	213	545	4964	135
Concrete mixer 60T/h	1,836.00	5,197	13,309	121,137	3,303
Water spraying trunk 5m3	22.50	64	163	1485	40
Crane K33-60	232.56	658	1686	15344	418
Air compressor 660 m^3/h	38.88	110	282	2565	70
Excavator 0.8 m^3	64.80	30	76	693	19

Plant	Fuel (liter/shift)	Total discharge/shift (g)			
		HC	CO	NOx	PM10
Bore piling machine	69.2	200	578	4,543	121

Based on the above table, the 60T/h concrete mixer is the plant which emits the highest level of emissions. Thus, emissions from the concrete mixing plant is selected to assess the dispersion of air pollution in the region by Gauss model:

$$C_{(x,z)} = \frac{M}{2\pi\sigma_y\sigma_z U}\exp\left[-\frac{1}{2}\left(\frac{z-H}{\sigma_z}\right)^2\right] + \exp\left[-\frac{1}{2}\left(\frac{z+H}{\sigma_z}\right)^2\right]$$

In which: $C_{(x,z)}$ – concentration of pollutants at x, y = 0, z (mg/m^3);

x – distance from the source in x direction x – of the wind (m);

z – height of calculation point (m);

M – pollutant discharge capacity (mg s^{-1});

H – effective height of the exhaust;

U – average velocity at height H;

σ_y – diffusion coefficient in horizontal direction y (m);

σ_z – diffusion coefficient in vertical direction (m).

The concentration of pollutants is calculated at 1.5 m height at different distances from the source of the pollution predicted by Gaussian model and assuming the average wind speed at the discharge gate of 3m/s. Pollutant concentrations are presented in Table 3.35 below:

Table 3.35: Pollutant Concentrations of 80T/h Concrete Mixers

Pollutants	**Pollutants concentration by distance (mg/m^{-3})**							
	10 m	30 m	50 m	100 m	150 m	200 m	250 m	300 m
HC	1.068	0.386	0.229	0.095	0.048	0.027	0.016	0.011
CO	2.735	0.988	0.586	0.244	0.123	0.069	0.042	0.027
NOx	12.446	8.997	5.336	2.221	1.124	0.630	0.382	0.247
PM10	0.679	0.245	0.145	0.061	0.031	0.017	0.010	0.007

Hot asphalt concrete mixer trucks are the largest source of pollution among all the plant listed above. With a 5m high stack, within 20m to the wind direction from the source, the concentration of dust in the air exceeds the permitted value of 0.30 mg/m^3 according to the QCVN 05:2013/TNMT; at a distance of 10m, the dust concentrations are 1.8 times higher than the permissible values. At 300m from the emission source following the wind direction, the concentration of NOx in the air exceeds the value permitted under the QCVN 05:2013/TNMT of 1.1x; at a distance of 10m, NOx concentration is 60 times higher than the permissible values.

As existing land use along the road alignment are mostly paddy fields and aquaculture ponds, and the nearest residential area is 450m-500 m distant, emissions from construction plant would affect the workers on the construction sites only.

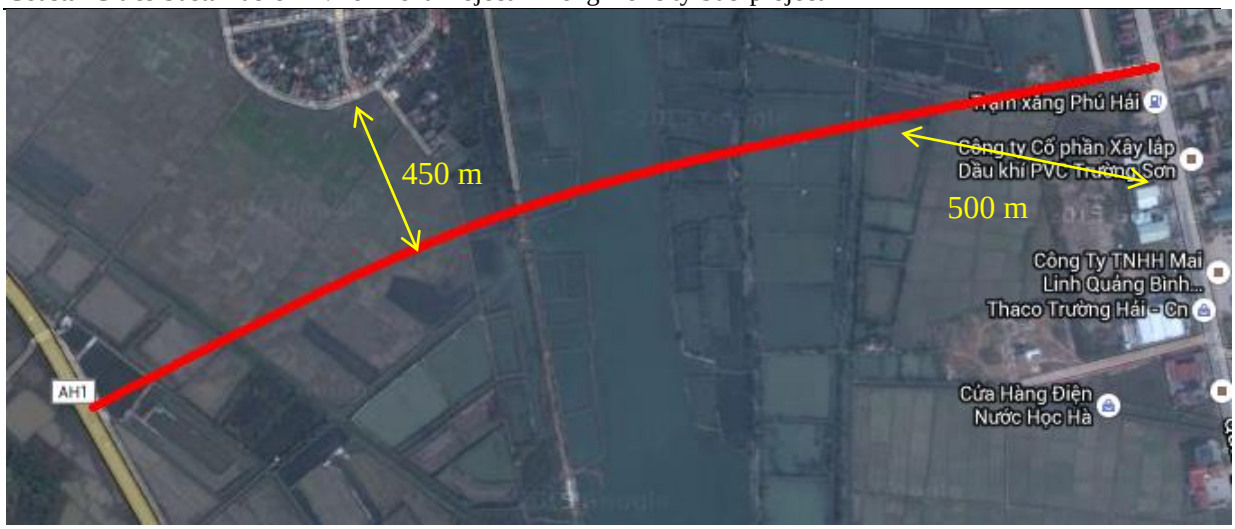


Figure 3.9: Distance from Residential Areas to Component 2 Construction Sites

(iii) Noise

Pile driving for bridge construction will create the highest noise, with bore pile drilling machines creating a noise level of 97 dBA on average at a distance of 15m. The noise level at a distance of 320m distance is about 70 dBA, and at a distance of 1,900m is approximately 50 dBA. The nearest residential area is over 500m from the construction area. Thus the noise has impacts on construction workers only, not on the residents.

(iv) Vibration

Vibrations are generated mainly from machinery during construction of roads and bridges. The vibration level will be evaluated by the vibration of the largest source generated by the machinery/equipment used for construction. In this case, the vibration caused by pile driving machines on Le Ky bridge and Tay Bridge is the largest.

Table 3.36: Declining Level of Vibration by Distance from Construction Activities of Component 2

Items	Max source vibration (r_0 = 10m) (dB)	Vibration level at a distance (*) (dB)			
		r = 5m	r = 10m	r = 15m	r = 20m
Roadbed construction (bulldozer)	82	77.2	53.9	30.9	8.3
Pile works (bore piles)	97.5	92.7	69.4	46.4	23.8
QCVN 27: 2010, allowable level of 75dB during 6÷21hand base level during 21÷ 6h					

Comparison of forecast results with the allowable limits according to QCVN 27:2010/TNMT found that the largest source of vibration are the bulldozers used for road construction and the pile driving machines used for bridge construction. As the impact has been excluded from the sources, the degree of the impact is negligible.

Conclusions

Impact level: <u>MEDIUM</u> and can be mitigated

<u>2. Wastewater/Stormwater Generation</u>

Wastewater generated in the construction process of Component 2 includes: (i) Domestic wastewater; (ii) Construction wastewater; (iii) Stormwater runoff.

(i) Domestic Wastewater

Component 2 construction comprises three contracts with 100 workers employed in a continuous 24-month period. Using the same formula used for Component 1 to calculate worker generated wastewater , Component 2 wastewater volume is 2.88 cmd (86.4 m^3/month). Load and concentrations of pollutants in wastewater are presented in Table 3.37 below:

Table 3.37:Pollutant Load in Domestic Wastewater of Component 2

Target	Emission coefficient (*) (g/person/day) mg/l	Pollutant load (kg/day)	Concentration of pollutants (mg/l)	QCVN 14:2008 Column B
BOD_5	45 - 54	4.50- 5.4	1,250– 1,500	50
Suspended solids	70 - 145	7.00- 14.5	1,944 – 4027	100
Lubricant	10 - 30	1.00 – 3.00	277 – 833	20
Total Nitrogen	6 - 12	0,60-1,20	166 – 333	50
Ammonium	2.4 - 4.8	0.24 – 0.48	66– 133	10
Total Phosphor	0.8 - 4	0.08 – 0.4	22– 111	10

With the emission load of pollutants forecasted above, the concentration level exceeds QCVN 14: 2008/BTNMT and the concentration of pollutants in wastewater without treatment will be many times higher than the allowable values. The expected construction period is 24 months, the total volume of waste water from each camp is 2.88 cmd (2,073.6 m^3). If it is not collected and treated, it will spread pathogenic organisms, and may affect workers' health. Wastewater with high levels of contaminants will flow into aquaculture ponds and rice fields around the construction areas causing water pollution, reduced agricultural productivity, impacts on the HHs with paddy fields and fish ponds around the road and bridge construction areas.

(ii) Construction Wastewater

Construction wastewater mainly comes from cleaning and maintenance of construction equipment and tools. The amount of wastewater generated depends on the frequency of vehicles usage, equipment in use, weather condition; water volume for washing a large vehicle is 300-500 liters/day (defined in Section 3.4 -TCVN 4513: 1988). The concentration of pollutants is presented in Table 3.14.

If it is not being managed well, the wastewater may enter existing agricultural land and irrigation canals at road side or other surface water bodies causing increases in turbidity and sedimentation. Wastewater may also enter the Le Ky River and the aquatic ponds. The risk is small and manageable since the area of existing agricultural land along the alignment is limited, and only some activities are carried out at the Le Ky river bank and on the river water surface. On the other hand, the Le Ky river is a relatively large river with high flow carrying capacity and dilution potential.

(iii) Stormwater Runoff

The total construction area of Component 2 is 95.040m^2. As calculated above (Component 1 - runoff calculation) the volume of stormwater runoff in the Component will be as follows:

$$Q = \Psi * F * q = 95{,}040 m^2 * 0.5546 m/day * 0.3 \approx 15{,}812 \text{ cmd.}$$

The entire water volume will flow into Le Ky River, irrigation canals on the crossing route, paddy fields, and aquaculture ponds. Stormwater runoff will erode soil from construction sites causing water turbidity, lower quality of river water and pond water, and increased sedimentation for irrigation canals, aquaculture pond and paddies.

Conclusions

Impact level: <u>MEDIUM</u> and can be mitigated

<u>3. Solid Waste Generation</u>

During construction of Component 2, the generated solid waste mainly includes: (i) domestic solid waste; (ii) construction solid waste; (iii) excavated soil from site clearance activities; (iv) hazardous waste.

(i) Domestic solid waste

With 100 workers working in Component 2 in two years, the amount of solid waste is calculated as below:

The highest amount of municipal waste generated from all construction sites of Component 2 is: 70 kg/day, the total amount of solid waste generated in two year is 50,400 kg. If not being properly stored and collected, and promptly transported, the domestic waste may cause odor pollution, garbage will attract rodents and other disease spreading organisms, and leakage will contaminate soil and water.

(ii) Construction solid waste

Construction solid wastes generated during the Construction of Component 2 are mainly: Gravel waste rock during construction, concrete mortar, concrete, plastic waste during road construction, materials packages, wood debris and steel ...These waste can be spent for different purposes, such as cement bags, iron and steel scraps can be sold to scrap metal purchasers. Unusable parts will be disposed at Cau Cup landfill.

(iii) Excavated Soil from site clearance

72,040 m^3 or 100,856 tonnes of top soil would be removed for road and bridge construction. All of these excavated materials will be reused for planting trees on the roads when construction is completed. Thus, it will be stored temporarily in the construction areas.

185-300 trees including eucalyptus, acacia, casuarina, bamboo, and wood species would be cut down during site clearance. Local people will collect them for beneficial use but a small amount of leaves and branches would be left at the site. This solid waste can be buried to generate organic humus. The emission into the environment is almost negligible.

(iv) Hazardous wastes

Small quantities of hazardous waste would be generated during the construction phase including gasoline, waste oil, oily rags, paint, etc. They are mainly generated from repairing and maintenance of vehicles, construction machinery and equipment.

If not managed properly, hazardous waste will pollute the soil and water significantly. These substances usually have high toxicity and capacity to spread, especially with the additional influence of stormwater runoff causing impacts on paddy fields and the aquaculture ponds.

Conclusions

Impact level: <u>MEDIUM</u> and can be mitigated

<u>4. Water Quality Reduction</u>

There are irrigation canals and aquaculture ponds along the road alignment, and at the Le Ky and Tay rivers where the two bridges cross. Water quality in these water bodies may be affected by: (i) the construction of abutments and piers on Le Ky River and the Tay Bridge; (ii) temporary storage of materials and solid waste; (iii) waste water emission. Total suspended solids, BOD_5, nutrients and coliforms are the main pollutants to be considered.

(i) Bridge Construction

With the construction method for bridge abutments shown in Figure 1.12 and described in chapter 1, the area to be affected by bridge construction would be limited: about 300 m^2 for abutment construction: about 300 m^2 and 200 m^2 for pile casting. The abutments and the piles

are covered with coffer dams made of steel sheet pile and the impacts on water quality will be minor, temporary and negligible.

Le Ky River and the Tay Bridge construction operation will be supported with barges, and there may be oil and grease on the barges which may leak into the river affecting water quality. However, the potential impacts on water quality of the construction of both bridges is considered to be limited.

(ii) Temporary storage of waste and materials

Surface runoff passing the temporary storage area of construction materials and top soil may wash away some of the granular materials causing an increase in water turbidity at the receptors such as the irrigation canal, aquaculture ponds and the Le Ky River. This potential impact can be mitigated.

iii) Wastewater

Wastewater from workers camps and construction site which contains a high content of SS, BOD_5 nutrients and coliforms may enter water bodies. Washing of the construction plants or tools are washed near or at waterbodies nearby the construction sites would also cause water pollution.

Conclusions

Impact level: MEDIUM and can be mitigated

5. Biological Impacts

The road and bridge construction under component 2 would result in the cutting down of 460 trees (eucalyptus, bamboo, acacia, casuarinas, melaleuca), and disturbance to 200m^2 of grassland in front of Phu Hai Ward Cemetery for camp and temporary storage areas.

Mimosa pigra, an invasive flora species has been found along the alignment. The construction area is still surrounded by rice paddies. If clearance of mimosa pigra is not carried out properly, its seeds, roots or shoots would invade the nearby agriculture land and affect crop productivity.

Emissions and dust from construction vehicles can reduce the yields of surrounding areas. Asphalt waste during road surfacing will affect the soil and agricultural ecosystem if they are not well managed.

Some aquatic organisms in rivers would be affected by the construction of abutments and piers of the Tay and Le Ky Bridges. However, the disturbed river surface area effect is quite limited. Some oil and grease from barges supporting bridge construction may affect water quality in the river, however, the impacts would be very minor as the amount of leakage would be very small and the risk is manageable. The potential impacts on aquatic species on the river is limited and negligible.

Conclusions

Impact level: LOW and can be mitigated

6. Impact on Landscape

Landscape along the road alignment will be changed permanently. Parts of agricultural land and aquaculture ponds will be replaced with a new road, footpaths and bridges. Some trees along the road alignment will have to be cut down during site clearance.

The landscape in front of Phu Hai Ward Cemetery will be disturbed during the construction phase. Although this is a sensitive site, there are no alternatives for workers camps, contractors offices and temporary materials storage due to absence of other vacant land available near the construction site.

Dust generated from trucks carrying construction materials from the borrow pit when travelling along the Ho Chi Minh Road and National Highway 1A may also have negative impacts on the urban landscape along these roads.

Conclusions

Impact level: LOW and can be mitigated

7. Subsidence and Landslide Risks

Soil subsidence risk on the project is considered low with the construction method proposed:

Abutments and bridge piers are to be constructed by the positioning of geographical coordinates and using coffer dams made of steel sheet piles before pile casting within an area of 10.1 x 33.1 (m). Pile boring and pouring of concrete inside the coffer dams will not cause subsidence. The construction procedure proposed is shown below in Fig 3.10:

Construction of bridge piers

Construction of bridge abutments

Figure 3.10: Construction Methods for Supports and Abutments

For road construction, the road foundation will be 2-3m higher than the existing ground level. Construction comprises the spreading and compaction of different layers of materials as follows: one layer of geotextile R = 12kN/m to make a separation layer between the foundation and the sediment layer; a layer of sand K90 of 0.6 – 1m thick spread for grading and prevention of higher sand layers from sinking into the weak soil layer below; weak soil foundation will be treated by vertical artificial drains arrange in "apricot blossom" form, 1.2m in distance, as deep as the weak soil layer; 0-2 geotextile layers R=200 kN/m will be spread horizontally to increase the stability of the road bed. The road bed configuration, pavement structure and surfacing layer support is shown in Figure 3.11. These construction measures will prevent settlement.

When cuttings and embankments are created, there are erosion risks that may lead to land slides and soil subsidence. This can be mitigated by having moderate , well compacted side slopes and by grass planting to protect the surface from erosion.

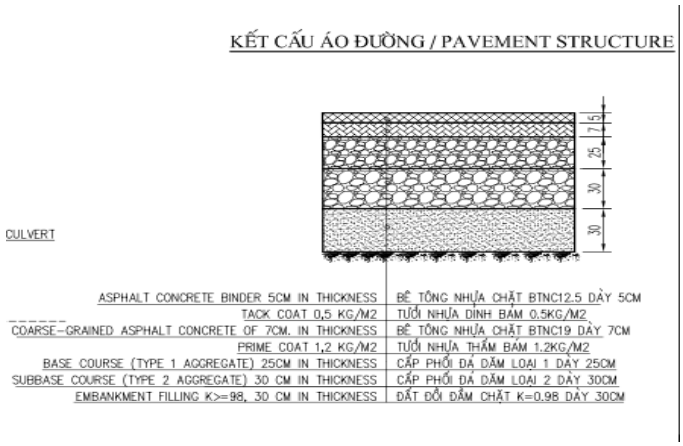


Figure 3.11: Pavement Structure

Conclusions

Impact level: LOW and can be mitigated

8. Flooding and Sedimentation Risks

The road cuts across and divides existing paddy fields and aquaculture ponds into two parts. The new road which is 2-3m higher than the existing ground may interrupt the flow in existing drainage channels, causing localized flooding in paddy fields, ponds and irrigation canals along the route.

Construction materials and waste from construction site may enters the existing drainage and irrigation canals causing sedimentation in these channels.

The temporary storage of materials or wastes, if not being well controlled, can block the existing drainage ditches. Then local flooding will occur when it rains.

The potential impacts are present during temporary storage of waste soil, and the impacts will be reduced when the waste soil is transported to other locations.

Conclusions

Impact level: MEDIUM and can be mitigated

9. Traffic Disturbance and Increased Traffic Safety Risks

The construction of roads and bridges under Component 2 will be conducted from two directions, i.e. one area from Highway 1 to Le Ky Bridge, the other from the city bypass to Le Ky Bridge.

The trucks transporting materials will also operate in these areas (as in Figure 3.12). Traffic safety risk will be increased at the two intersections at the two ends of the road, and traffic density on NH1A and Quang Trung Road will be increased. The estimated number of vehicles carrying materials and concrete to the construction site is 16,770 vehicles/24 months, which is 23 trips/day if using vehicle load at 12-15 tonnes. On Quang Trung Road, traffic safety risk would be increased as currently different types of transport means have been travelling on this roads, including trucks, cars, motorbikes and bicycles. The speed limit on the road at the intersection with Highway 1A is also high (80 km/h).

The potential impacts and risks related to traffic disturbance and traffic safety are significant and manageable by application of appropriate mitigation measures.

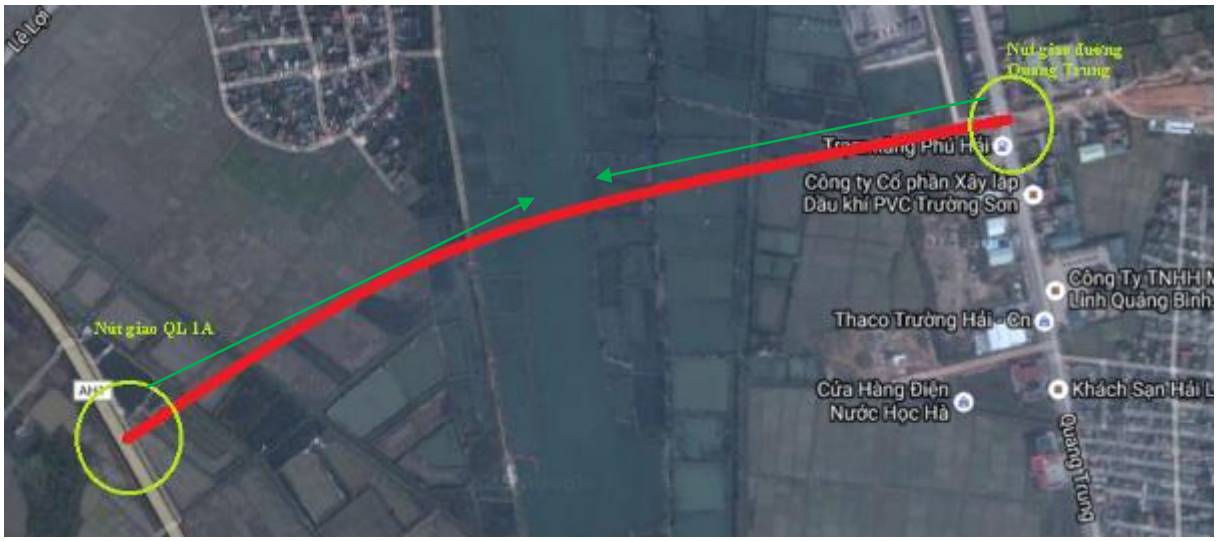


Figure 3.12: Traffic Routes During Construction of Road, Le Ky and Tay Bridges

Waterway traffic on the Le Ky river would also be affected during bridge construction. At the construction site of Le Ky bridge on Le Ky River, the river is 200m wide, the bridge abutment construction and barge operation occupy an area of 500m^2 with a width of 60m horizontally. This narrows the riverbed to 140m wide for waterway traffic. However, since only small boats travel on the river, the risks for water traffic are minor.

The construction area will divide the road access used by farmers and provision will need to be made for farmer access to aquaculture and paddy fields.

The sewer route from Bao Ninh peninsula will be clamped underneath Le Ky and Tay bridges and the bridge clearance will be ensured. Hence, there will be no impact during the bridge construction and operation phases.

Conclusions

Impact level: MEDIUM and can be mitigated

10. Impacts on Infrastructure

The construction of the proposed road and two bridges will require acquisition of 500m^2 of temporary houses, mainly on fishery ponds and not for residential purposes. It will also disrupt the operation of three irrigation canals serving rice and fishery cultivation in the project area. The route will divide the fishery ponds and rice paddies, and affect the three intake culverts of fishery ponds.

Conclusions

Impact level: MEDIUM and can be mitigated

11. Social Impacts

Social impacts during the construction of the road and bridges may include:

- Disruption to the existing sluices and irrigation canals, nuisance resulted from construction materials and wastes entering irrigation canals or agricultural ponds
- Social disturbance related to the mobilization of 100 workers to the construction sites from other localities. Conflicts between local people and workers may be arisen due to different living customs, different jobs and incomes, or involvement in social evils (drinking, prostitution, or steeling fish from farming aquaculture ponds etc.) . However, these impacts can be mitigated by the application and enforcement of Workers' codes of conducts detailed in Chapter 5.
- Disturbance of accessibility of farmers to the existing rice field and aquaculture ponds, particularly when they transport production materials as seedling, fertilizer to the farms or harvest the products, because the new road is 2-3 m higher than the existing ground level
- Agricultural productivity may be affected by the negative impacts of wastewater, dust, gas emission and solid wastes on rice paddies and fishery ponds.
- The to-be-constructed road cutting aquaculture ponds and rice fields will not pass by residential land or houses. 101,413m^2 of rice land and aquaculture land of 43 households will be acquired, however, the project has provided adequate compensation at market prices, and support and allowances for occupational transition, employment, and fishing tackles, including nets, pumps, and aerators, for aquaculture farming households. There are 19 severely affected households with more than 70% of land is acquired, and 24 households have 20% - 70% of their land acquired. Hence, the affected households still have productive land along the road to maintain their livelihoods, plus allowances provided by the project for new livelihoods. As a result, the impacts caused by land acquisition are considered as medium.

- The 100m-long section, starting from the T-junction with Quang Trung road, is the most closely-located to a residential area; accordingly, distances from the road center line to the residential areas range from 100m to 150m. About 15 households at this site will be likely affected by dust and noises generated by construction activities and social dis-orders resulted from mobilization of construction workers; the site landscape and aesthetic views of local houses will be degraded.
- The agricultural land (along the road sides) that will be changed into residential land in accordance with the master plan of Dong Hoi city is not covered in the scope of investment of the CCSEP. Thus, the road and bridges along the 1.44 km-long road have been considered to align the master plan and provide convenient access for farmers when the agricultural land is not yet changed for residential purposes.

Conclusions

Impact level: MEDIUM and can be mitigated

12. Impacts on Cultural, Historical, and Religious Works

The Phu Hai Ward Cemetery will be affected by road construction :

- Dust released from construction materials temporarily stored in front of Phu Hai Ward Cemetery when south-easterly wind is blowing will affect conditions at the cemetery. During two years of the road construction, dust will cause impacts on growth and development of plants and trees in the surroundings and inside the cemetery.
- There will be visual impacts of the camps and other temporary facilities area temporarily located in front of the cemetery; the grass cover in front of the cemetary is disturbed.
- Access to the cemetery may be obstructed.

Conclusions

The impacts on this sensitive receptor is considered as MEDIUM and can be mitigated.

13. Community Safety and Health

During construction, there will be the risk of people's safety and health around construction areas including risks of traffic safety at the two intersections and for farmers going to and from their farms along the road; dust and gases from vehicular exhausts affecting farmers' production activities around the construction areas. However, the exposure is small because farmers do not always stay for long time in this area.

Conclusions

Risk level: LOW and can be mitigated

14. Workers' Safety and Occupational Health

Construction activities such as removal of top soil, loading and unloading materials, and operation of construction plant including excavators, cranes, trucks, welders, and concrete mixer trucks are risky for workers unless adequate safety measures are in place.

The storage and use of fuels such as power, gas, and petrol may cause shocks, fire, explosion, or leakage leading to pollution and have a resulting impact on workers' health.

When working on construction sites with a variety of materials, plants and equipment, or at high positions when building the bridge pier of 5 - 5.5m above water surface, there will be risks for workers such as falls, drowning etc. Workers need proper protection against these events.

If accommodation conditions including adequate water supply and sanitation are not ensured, workers' health will be affected in the short and long term.

In addition, weather factors such as high temperature 40 deg C in Dong Hoi city during summer can also have negative impacts on the health safety of workers. All risks of accidents or incidents during the construction phase can be proactively prevented.

Conclusions

Risk level: LOW and can be mitigated

3.3.2.3 Site-specific Impacts of Component 2

Table 3.38: Site-Specific Impacts for Component 2

Km	Issue/Impacts	Image
0	Beginning point is connected with Quang Trung Road: traffic safety risks	
50 m	Phu Hai ward's cemetery is 50m from the road: + Visual impacts, landscape + physical cultural resources + impacts on vegetation cover and trees + Worker's camps and temporary storage areas will be placed on part of the vacant land in front of the cementer	
	Chu Văn An school is 200m from the road: + Traffic and Safety + Noise and dust	
60 m	The road cut through abandoned rice field, some garbage and waste are dumped there Some houses at the far end	
0+300m	The road cut through rice field	
	A feeder canal (cross section of 1,0m) and casuarinas trees, 4-5m high, will be affected by land acquisition.	
	Mimosa Pigra, an invasive plant species presence in this area.	

Km	Issue/Impacts	Image
0+395m	The road cut through abandoned aquaculture pond	
	The road cut through the main 20 m wide earthen irrigation canal + disturbance to irrigation service + Drainage function may be affected + some trees along the canal	
0+500m	The road crosses the earthen irrigation feeder canal	
	The road crosses the aquaculture ponds	
0+600 m	Starting point of the access to Le Ky Bridge, the road crosses Le Ky embankment with an existing path for pedestrians Camp and temporary storage area on vacant at riverside (available space very limited)	
0+700 m	Le Ky Bridge, 212m long, 30m wide, 6 spans (7 piers), each span is 33m long, the bridge's width is 30m.	
0+800 m	The road cuts through aquaculture ponds outside the embankment of the Le Ky river.	

Km	Issue/Impacts	Image
0+ 900m	The road crosses the abandoned lagoon located between Cau Tay and Ky river.	
0+ 1200m	The road cuts through rice fields intersected with aquaculture ponds	
0+ 1300m	The location of planned West Bridge with one span, 24m long and 21m wide. Lots of mimosa pigra are found in this area.	
0+ 1340m	The road crosses aquaculture ponds	
0+ 1440m	Traffic safety risk at the junction with the road (The new road will end at the intersection with Dong Hoi city bypass. There are no residents but two farms)	 

3.3.2.4. Operation Phase of Component 2

Operation of the 1.44 km long road will cause the following impacts on the environment and society:

1. Traffic Disturbance and Increased Traffic Safety Risk

The forecasted traffic volumes on the road are shown below. According to the Feasibility Study, the projected traffic flow upon project completion is presented in Table 3.39:

Table 3.39: Forecast of Vehicles Flow in the Designed Route

No.	Vehicles converted to cars	Unit	Year 2023	Year 2025	Year 2030	Year 2035	Year 2040	Year 2045
Station 1 (HW1A)	Ntl	turn/day	5,468	6,617	10,657	17,163	27,641	44,516
Station 2 (bypass)	Ntl	turn/day	5,812	7,033	11,327	18,242	29,379	47,316
Station 3 (HCM Road)	Ntl	turn/day	2,414	2,921	4,705	7,577	12,203	19,652
Designed route	Ntl	**Turn/day**	**5,640**	**6,825**	**10,992**	**17,703**	**28,510**	**45,916**

In the table above, non-motorized and motorized vehicles have been converted into cars. In fact, there will be both non-motorized and motorized vehicles travelling on the new road. There are traffic safety risks due to the separation and integration of the travelling vehicles at the intersections. The design also includes the extension of local feeder roads and main roads to ensure the safety of traveling people and prevention of impacts on agricultural productions.
Currently, only small boats are operating and Le Ky bridge design also has navigable waterway height, thus waterway traffic will not be affected.

Conclusions

Impact level: MEDIUM and can be mitigated

2. Air Pollution

When the roads and bridges are in operation, dust and gas emissions (SO_2, NO_x, CO, HC) will be generated from fuel combustion of vehicle motors. The vehicles traveling on road will generate dust, noise, and vibration. The number of vehicles operating on the road is estimated to be as follows:

Table 3.40: Forecast of Travelling Vehicles

No.	Unit	Year 2023	Year 2025	Year 2030	Year 2035	Year 2040	Year 2045
Designed road	Turn/day	5,640	6,825	10,992	17,703	28,510	45,916
	Km/day	8,122	9,828	15,828	25,492	41,054	66,119

(Source: Feasibility Study 2016)

The traveling vehicles are converted into 4 seat cars (Engine:1400 -2000 CC).
The amount of dust generated when operating vehicles is estimated as follows: The dust emission coefficient from road (kg / 1,000km/vehicle) is 4.4; the load of dust emission from vehicle tires rolling on the road is shown in Table 3.41

Table 3.41: Forecast of Pollution Dust Load on Roads

Year	Vehicle flow (unit/day)	Vehicle flow at high time (unit/h)	Dust load rolled from the roads (mg/m.s)
2023	8,122	650	0.79
2025	9,828	786	0.96
2030	15,828	1,266	1.55
2035	25,492	2,039	2.49
2040	41,054	3,284	4.01
2045	66,119	5,290	6.46

* Degraded air quality:

The forecast of dust and gases (SO_2, NOx, CO, HC) from fuel combustion generated by vehicles operating on the road is conducted on the following basis: the data of forecasted traffic flows on the road during the years 2023-2045, the traffic flows at rush hours are estimated to account 8% of the total daily traffic flow; the national technical regulations on gasoline and diesel (QCVN 01:2007/BKHCN) set the level of sulfur in petrol and diesel in traveling S = 0.05%

(converted into cars). The pollution coefficient in the air generated by fuel combustion of cars (Engines: 1,400 -2,000 CC), and the emission levels at rush hours forecasted at different years are as follows:

Table 3.42: Forecast of Air Pollution Load on Roads

Year	Vehicle flow at high time (unit/h)	TSP (mg/m.s)	SO_2 (mg/m.s)	NO_x (mg/m.s)	CO (mg/m.s)	HC (mg/m.s)
Emission coefficient	*1,000km*	*0.07*	*2,05S*	*1.33*	*6.46*	*0.6*
2023	650	0.13	3.70	2.40	11.66	1.08
2025	786	0.15	4.48	2.90	14.11	1.31
2030	1,266	0.25	7.21	4.68	22.72	2.11
2035	2,039	0.40	11.61	7.53	36.60	3.40
2040	3,284	0.64	18.70	12.13	58.94	5.47
2045	5,290	1.03	30.12	19.54	94.92	8.82

Dust and emissions from vehicles operating on road and bridges of the project: As mentioned above, except the intersection with Highway 1A, the roads and bridges of the project are distant from residential areas, hence dust emissions from traveling vehicles do not cause a significant impact on the health of people. In reality, the operation of the city bypass nearby has created negative impacts on the agriculture and aquaculture productivity along roadsides.

Noise: Based on the forecast on traffic on the route in future, the projected noise from the road is over 70 dB within a distance of 100 m after 2020, and within a distance of 120 m after 2025.

On the project road, except at the point of intersection with Highway 1A near the houses, offices, martyrs' cemetery, the road goes through the field area, fishery ponds and far from residential areas, therefore the overall impact of noise is minor.

Conclusions

Impact level: MEDIUM and can be mitigated

2. Pollution risk on the Le Ky river

As the sewer would be installed under the Le Ky and Tay bridges to convey 1,990 cmd of domestic wastewater from Bao Ninh peninsula to the Duc Ninh WWTP, if the sewer pipes installed under the bridges are leaked or broken, wastewater would enter the Le Ky and Cau Tay rivers causing water pollution. This would result in poor agricultural productivity and affect the surrounding landscape. However, this risk is very low as this type of structure had been designed and built in other projects, including the Nha Trang subproject under CCESP and the system has been working well since then. This risk can be controlled with appropriate design, technical measures and operation plans.

Conclusions

Impact level: LOW and can be mitigated

3. Flooding and Erosion

The road foundation level after construction will be higher than the adjacent rice cultivation area. This can cause flooding of the cultivated areas if the drainage system does not operate efficiently.

Conclusions

Impact level: LOW and can be mitigated

4. Disrupt Accessibility

The constructed road will be constructed on a low embankment adjacent to the surrounding cultivation areas. As the road is 2-3 m higher than the existing ground level, it will be difficult for the farmers to enter and exit the new road from their farm land, unless access is provided.

Conclusions

Impact level: LOW and can be mitigated.

5. Induced Impacts

At present, existing land use along the road alignment are rice field and aquaculture ponds, there are no residential houses along the alignment. The shortest distance from the alignment to an existing house is 100-150 m, at the beginning section. When the new road is built and operated, land use along the road alignment will be changed in the tendency that residential houses will be built along the 1.44km road alignment. As the result, agricultural land will be changed to urban residential area. In fact, in the future, the area along the road alignment will be change to urban residential area in accordance with the city's Masterplan. The existing houses that are closest to the alignment will remained to be several rows back from the new road after new houses are built on existing agricultural land along the alignment thus land price of these existing residential houses are not expected to increase abruptly. Therefore, the potential induced impacts would be undercontrol. There is no foreseenable adverse potential environmetal impacts that could happen in the area along the road after it is built according to which land use along the proposed road has also been planned for urban residential land as shown in the map below.

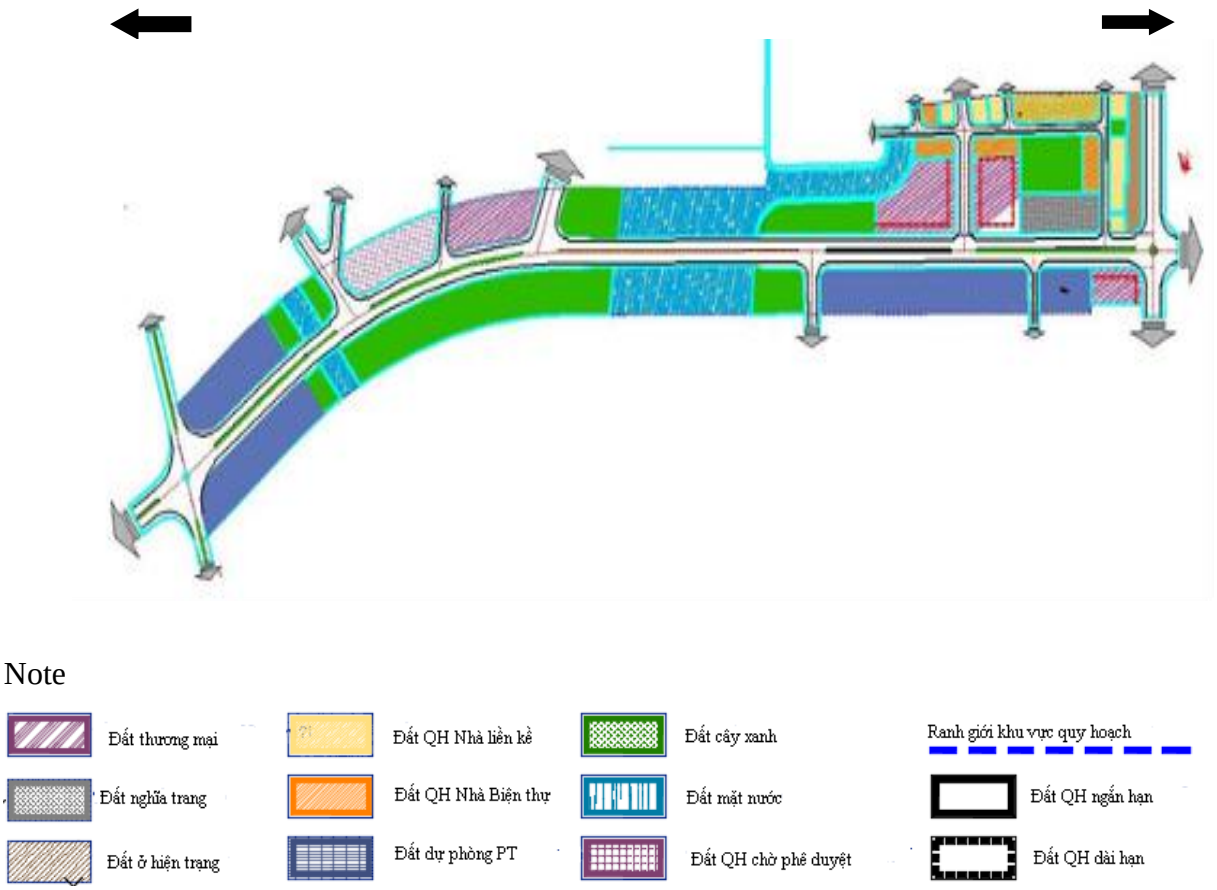


Figure 3.13: Proposed Land Use along Proposed Road Alignment

Conclusions

Induced impact MANAGEABLE.

3.4. CUMULATIVE IMPACT

Two projects were considered for cummulative impacts assessment:

- Coastal Cities Environmental Sanitation Project - Dong Hoi Sub-project (Funded by the World Bank, implemented from 2006 to 2014)
- Urban Environment and Infrastructure Development for Climate Resilience Project, Dong Hoi Subproject (funded by the Asian Development Bank, implemented from 2015 to 2020)

The two main projects related to CCSEP are briefly summarized below:

1. Project name	Coastal Cities Environmental Sanitation Project (CCESP) – Dong Hoi city sub-project
Description	Content and construction scale **The project consisted of six components** ▪ Component 1 - Drainage and sewage collection; ▪ Component 2 - Construction of the wastewater treatment plant; ▪ Component 3 - Solid Waste Management; ▪ Component 4 - Resettlement and land clearance; ▪ Component 5 - Household sanitation improvement revolving fund; ▪ Component 6 – Project implementation strengthening and support. **The invested construction works** - Main sewer system (16.2 km), wastewater collection interceptor HDPE (26.3 Km), tertiary sewers connected to HHs (24.1 Km); - Manholes of main sewers (1,063 manholes), HH connection manholes (2,892 manholes), odor prevention manholes (593 pits); - Installation of combined sewer overflow system (11 systems), pumping stations (14 stations); - Sloping roof embankment with stone (11,773 km), channel dredging, sewerage dredging; - Construction of Duc Ninh WWTP using aerobic ponds technology with capacity of 10,000 cmd by 2020 and 19,000 cmd by 2030; - Construction of school toilets (19 toilet), public toilets (04 toilets); - Rehabilitation of Ly Trach landfill, supplies of equipment for collection, management of solid waste and drainage management systems; - SCADA systems for automated management of wastewater collection and treatment system. **Funding source: The World Bank (WB)** **Implementation period: 2007 – 2014** **Relations to CCSEP** In order to consolidate the results of CCESP, ensure the optimal investment performance as well as improve and synchronize the effectiveness of the project, CCSEP should be funded to continue with infrastructure construction such as sewers, manholes, pumping stations, and equipment of Duc Ninh WWTP, toilets, bridges and road system. The entire construction category of CCSEP is closely related to CCESP.
Status	The project was completed and the works have been put into operation.
EIA status	EIA Report on Dong Hoi Subproject Phase I, CCESP approved by Quang Binh PPC by the Decision No 953/QD-UBND dated 12/04/2006, and No.1805/QD-UBDN dated 17/7/2009;
Cumulative impact assessment	The Coastal Cities Environmental Sanitation Project (2006-2014) and CCSEP have a common goal: Improving the sanitary conditions, health and

	living standards for the city people and promote tourism development. Two project implemented in series can produce positive impacts and achieve uniformed results. Besides, there will be some negative impacts, including: + Increased air pollution caused by transportation activities, + Increased amount of treated wastewater discharged from Duc Ninh WWTP from 6,200 cmd to 14,000 cmd to Le Ky River; + Increased volume of solid waste that require treatment; + Increased number of issues related to social security, social crimes, health and healthcare (increasing number of tourists due to tourism development)
Review rating	It is necessary to promote the positive impacts of the two projects. The CCESP (2006-2014) will provide many relevant useful lessons and experience learnt from project implementation to CCSEP.

2. Project name	Urban Environment and Infrastructure Development for Climate Resilience Project, Dong Hoi City, Quang Binh province
Description	**Works relating directly to the CCSEP:** (i) Bao Ninh wastewater collection system: including 13.1 km of gravity drains, 3.5 km of pumping mains, and 3 pumping stations. (ii) Household connections (8,238) and tertiary drains (55.6 km). (iii) One pumping station and one Combined Sewer Overflow (CSO). **Funding source:** Asian Development Bank (ABD) Implementation period: 2015 – 2020 **Relations to CCSEP** The aforesaid works of the Urban Environment and Climate Change Adaptation Project – Dong Hoi city sub-project, Quang Binh, upon completion, will collect an estimated wastewater volume of 1,990 cmd of Bao Ninh peninsula to Duc Ninh WWTP, increasing the WWTP treatment capacity to 14,800 cmd.
Status	Loan is being processed.
EIA Status	EIA Report of this project was approved by Quang Binh PPC has approved under the Decision No 915/QD-UBND dated 14/4/2014.
Cumulative impact assessment	Upon completion, the project will collect wastewater of 1,990m^3/ day to Duc Ninh WWTP. The cumulative impacts are assessed during the operation of 2 projects as follows: + Impact on Le Ky River water quality: The capacity of Duc Ninh WWTP will increase up to 14,800 cmd when receiving wastewater from Bao Ninh, thereby increasing the discharged volume into Le Ky River (measured in detail in the impact assessment report for operation phase of Duc Ninh WWTP). + Impact on the traffic: During the operation phase of the two projects, traffic between Bao Ninh peninsula and the inner wards of Dong Hoi City, as well as between the city and Highway 1A become more convenient, increase the traffic operations causing higher pollutant emissions and lower traffic safety; + Increased number of issues related to social security, social crimes, health and healthcare (increasing number of tourists due to tourism development).
Review rating	Two projects will be implemented in the period 2016-2020 but in two different areas separated by Nhat Le River. Therefore, the simultaneous negative impacts caused by the construction process will be reduced. However, Dong Hoi city should closely monitor the environmental aspects in construction contracts to ensure that the environmental pollution problem is minimized.

The table of Components Ecological Value (VEC_s) below may be affected by the project. The VEC_s were selected and evaluated based on relevant projects which may have cumulative impacts on the project area:

- Water environment:

  With the maximum waste discharge rate at 14,800 cmd from the Duc Ninh WWTP, the Le Ky River is capable to receive BOD5, COD, Phosphorous and Coliform, TSS, Nitrate, Nitrite, Ammonium from other sources. In otherwords, when the WWTP is fully operated in the normal conditions, the water in the Le Ky river still meet the applicable QCVN.

  Even when the treatment efficiency of Duc Ninh WWTP is <50%, the concentration of some pollutants in wastewater flowing into Le Ky River may exceed the QCVN 08: 2015/BTNMT (National Technical Regulation on surface water quality). The incident would cause water quality degradation in Le Ky River thay may affect local surface aquatic species. This incident will be fixed when the treatment efficiency of the plant is restored to above 90%.
- Air environment
- Aquatic biodiversity
- Local people's living quality.

The screening of cumulative impacts is presented in Table 3.43 below:

Table 3.43: Screening of CCSEP Cumulative Impacts

Key elements	Mean total score	Development activities in the project area				
		Prior to 2016		2016-2020		
		CCESP	Dong Hoi North West IP	CCESP	Bao Ninh Development Project (ADB)	Soil, rock mines
Project construction phase						
Water environment	-1			-1	-1	-1
Air environment	-1			-1	-1	-1
Aquatic biodiversity	-2			-2	-2	-1
Life quality	-1			-1	-1	-1
Project operation phase						
Water environment	-1	-1	-1	-1	-1	
Air environment	-2	-1	-2	-2	-1	
Aquatic biodiversity	+1	+1	-1	+1	+1	
Life quality	+2	+2	+1	+2	+2	

Note:

+, -: relatively positive and negative impacts

0, 1, 2, 3: insignificant, small, medium, significant level of impacts

Based on the screening table, it is possible to note that the aquatic biodiversity will be most affected by the cumulative impacts of simultaneous construction projects. When the project is put into operation phase, the air environment will be most affected by negative impacts, and people's life will enjoy the most positive impacts.

CHAPTER 4: ALTERNATIVE ANALYSIS

4.1. WITHOUT-PROJECT

If the CCSEP project is not implemented, the problems of flooding and environmental sanitation will not be solved completely.

When the tourism service centers and new urban areas are developed in the city center in accordance with the approved plan, the hospitals, schools, sport and recreation centers will also be built. Urbanization rate in Dong Hoi city is very fast meanwhile the sewerage system has been overloaded or degraded in some areas. Without the proposed investments, flooding and pollution issues will become more and more serious in those areas and lead to the below implications:

- Traffic jams, and roads damaged by flooding
- The pollution continues getting worse, the undischarged waste water will lead to the risk of epidemic diseases and affect community health.
- Flood drainage capacity in Cau Rao River, especially at Cong Muoi Bridge segment, will continue to be limited. Flooding will continue to happen leading to economic and social losses and risks for safety of city people.
- Implementation of other planning tasks has to face more difficulties and affect the economic, cultural and social development of the city.

4.2. WITH-PROJECT

- Reduce the damages caused by flooding for Dong Hoi city through upgrading and construction of stormwater drainage system, and dredging rivers and reservoirs;

- Improve the environmental and health conditions for people in the city through upgrading and extending the current wastewater collecting system, and building wastewater treatment plants in order to reduce environment and surface water pollution; proposal of improving family sanitation via revolving fund;

- Assist in capacity building in collection and transportation of garbage and solid wastes. Improve solid waste management and urban sanitation through capacity building, supplement media and equipment for maintaining and managing drainage systems, improve management capacity for Urban Construction Company, Water Supply and Sewerage Company, related departments of Quang Binh city and community;

- Contribute to completion and development of infrastructure, improve the urban landscape, and promote the general development of the city.

4.3. TECHNICAL OPTIONS CONSIDERED

During the project preparation, the below technical options have been considered

❖ **Selection of Sewer and drainage Routes**

Determination of sewers direction and location (on the road or pavement) has taken into consideration the status of existing roads, pavements, underground works (water supply, electric lines, phone cables), trees, power poles, etc. and the areas need to be clearance

When the pavement is wide enough, sewers are designed to install on the pavement, if not, the sewers will be in stall on the road.

❖ **Design of the Cong Muoi bridge**

During feasibility study, the environmental team commented that the bridge look quite heavy on a landscaped riverbank areas. As the result, the structural design of the bridge were improved and suite the surroundings better.

The selected design of the proposed new Cong Muoi bridge is shown in the photo.

Figure 4.1: Cong Muoi Bridge Architecture

❖ **Selection of Road Routes**

Various alternatives alignment have been considered during the feasibility study. Priority were given to those alignments which passing fewer residents or those running along existing roads.

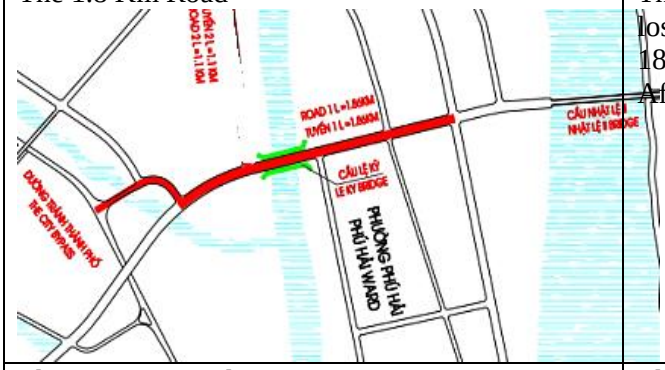
Two options were evaluated for the road proposed under component 2. Option 1 proposed a1.8 km long alighment and option 2 proposed 1.44 km alignment. The two options share the same alignment design from km 0 - km 0+1300m. The differences is from km 0+1300 to the end point.

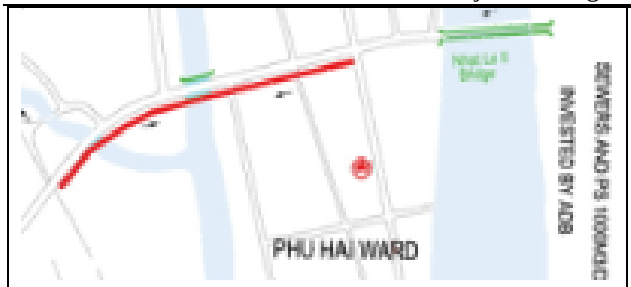
In Option 1, at km 1.3 of the alignment, there is a sudden rightturn toward the northwest then west to the end point. In option 2, the turning section of section 1 has been replaced with a section smoothly turning southwest to another end point as shown in the map in Table 4.1

Option 2 was chosen because the alignment is shorter and smoother with the following implications: i) less land area to be acquired (14.2 ha instead of 18.3 ha) and less households are affected (85 instead 94), Filling materials is reduced from approximate 198,200 m3 to 119,000 m3, thus the investments costs would be reduced. Traffic safety risks and GSH emissions from vehicles during operation phase in option 2 would be lower than option 1.

The selected alignment mainly cut through ricefields and ponds thus the number of people affected during construction phase is minimised. The selection plans are compared and selected as shown in the Table 4.1 below.

Table 4.1: Comparison of Road Selection Plans for Component 2

Road map	Site clearance scale	– construction impact	Impact in operation phase
The 1.8 Km Road 	The permanent lost area: 183,246.20 m^2 Affected HHs: 94	The amount of soil to be backfilled: 198,243 m^3	High risk of accidents for traffic on the curved road.
The 1.44 Km road	The permanent lost area: 141,655.20 m^2 Affected HHs: 85	The amount of soil to be compensated : 118,746 m^3	Ensure safety when connecting to the current road

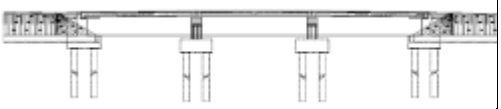
	The number of land acquisition HHs decreases	Reduced the amount of compensated soil.	The road is straight and convenient, reduce transportation risk, decrease emissions from car when running

At the intersections with NH1A, different options have been considered, and necessary adjustments have been made to ensure different traffic means (trucks, motorbike etc.) can enter and exist the new road safely with least disturbance to the traffic flow on the NH1.

❖ **Selection of the Cong Muoi Bridge Construction Plan**

Architecture design is proposed base on the principle of highly complying with the plan and status of the bridgeheads. Therefore, in order not to break the urban architecture, the new bridge design has to minimize the raising of the bridge. Two designs have been compared and selected as below:

Table 4.2: Comparison of Cong Muoi Construction Design

No	Name of design	Strong points	Weak points
1	Design 1: 3 span, 18m bridge 	- small structural height. - not raising the road at the bridgeheads	- Higher price than design 2 - more materials used.
2	Design 2: 1 arch and two joist span bridge 	- Nice structure - Less expensive than Design 1	- raise the road at the bridgeheads from 0,3 to 1m.

❖ **Select opportunities to increase landscape effect after project implementation**

- When implementing the project, the empty land areas near construction sites such as the empty area in front of Phu Hai martyrs' cemetery can be used for temporary material gathering. After the construction complete, a plan for compensation and improvement of the site for trees and flowers growing will be conducted to improve the aesthetic properties for the area;
- The empty area 100m from Dai Giac Pagoda can be used temporarily to park dredging machines for Cau Rao River dredging work. After completing the work, the area will be leveled for growing green grass in order to improve the aesthetic property for the pagoda and create a landscape for the whole area.

CHAPTER 5. MITIGATION MEASURES

The project's potential impacts will be managed through the measures proposed for pre-construction, construction and operation phases. Some of the mitigation measures and environmental solutions are also incorporated into engineering proposals in order to enhance the positive impacts and sustainability of the project proposals, or to avoid, prevent or mitigate the potential negative impacts that may occur during construction or operation phases.

5.1. MITIGATION MEASURES FOR PRE-CONSTRUCTION PHASE

5.1.1 Measures to Mitigate impacts from Land Acquisition

The project will acquire 141.655,2m^2 of agricultural land, water surface, and public land. As mentioned in Chapter 3, 85 households or 454 people will be affected by land acquisition, however, no households would be required to resettle. To manage the potential impacts related to land acquisition and site clearance, the Project has prepared a Resettlement Action Plan (RAP) with a budget of VND **71,862,554,265** to support the households affected by land acquisition. The main contents of RAP is summarized in Tables 5.1 and 5.2 below:

Table 5.1: Entitlements for Affected Households (AHH) and Persons (AP)

Type of Impacts	Entitlement by Category
Agricultural land acquisition	**1. HHs affected with < 20% of production land area or < 10% for vulnerable group** For those who have the right to legally use or can legalize the land use right, the project will compensate "land for land" or compensation in cash for the land and assets on the land at 100% replacement cost.[13]. If the area of the remaining land after acquisition is not enough to continue cultivation, the project will acquire the entire piece of land and compensate by "land to land" or in cash. Affected households are also supported with livelihood recovery assistance such as cash, vocational training and job creation: For the people who use temporary land or leased public land of wards/ commune, compensation shall be provided for investments made on the land. These PAPs will also receive additional support for income rehabilitation if they are directly involved in agricultural activities. For other cases, affected people who lease land shall be compensated for cost of investment in remaining land and assets they create on the land with 100% replacement cost. For those do not have legal land use rights and if *the* land used before July 1, 2004, land users will be compensated for 100% replacement cost. For other cases, affected people will receive assistance equivalent to the value of remaining investment on the land. Households affected by loss of less than 20% of land, where the remaining land is rendered unviable for continued use, will be assisted with the above support plus any additional support as determined, for a period of 12 months.

[13] When regulations of the State and the province don't meet standards of compensation at replacement cost, compensation under domestic law is supplemented by necessary assistance measures to meet the replacement cost standard.

Type of Impacts	Entitlement by Category
	2. **HH seriously affected (loss of ≥20% production land or ≥10% with vulnerable groups)** Afffected HHs who have right to legally use or can legalize land use rights will receive compensation and assistance and allowance. Support for life stabilization is in cash equivalent to 30 kg of rice / person / month and: (i) PAPs losing 20 - 70% of their agricultural landholding (or 10 - 70% for the poor and vulnerable groups) will be compensated with 6 months income from that land; PAPs losing more than 70% of their agricultural landholding will be assisted with 12 months income from the land or at the provincial policy, whichever is higher; (ii) Poor households who lose ≥ 20% of production land, or lose less than 20% but the remaining land for cultivation is not enough will be supported by cash equivalent 30kg rice /person/ month for 24 months. Other poor households is supported by cash equivalent 30kg rice / person / month for 6 months or at the provincial policy, whichever is higher. (iii) Other vulnerable groups: female headed households with dependents, households with disabled people, elderly without support and families of ethnic minorities will get allowance at the provincial policy or the money allowance equivalent to 30 kg of rice / person / month for 6 months, whichever is higher. For people who use temporary land or leased public land of wards/ commune, or those do not have legal land use rights will also receive Compensation and assistance
HH affected with non-agricultural land and business	***Marginally affected (<20% land or <10% to vulnerable/poor HH*** HH or AP have Land use rights certificates (LURCs) or are eligible to have LURC will be compensated with "land for land" or cash at replacement cost. HH or AP who use leased land will be compensated equivalent to remaining values invested in such lands and assets on the land at 100% replacement cost. Allowance for production, business rehabilitation: (i) Businesses / households with business registration will be compensated or supported. The maximum compensation/support is 30% of after-tax income of 01 years based on their average annual of the last three years which have been declared to the tax authorities; (ii) Households without business license but who have met their tax obligations will be entitled to compensation equivalent to 50% of support level for businesses/households with business registration.
Houses and structures	Owners of Partly affected houses/ structures built before the cut-off date will be compensated in cash for affected part of the project at 100% of the replacement costs. If the works affected partly, users will be paid an allowance of repair.
Crops and Trees, livestock	For annual and perennial standing crops, compensation will be paid to households who cultivate the land with full replacement cost. For plants which have not been harvested yet but can be brought to another location, the transportation cost and the actual damage due to the transportation and re-planting must be compensated No compensation for livestock which could relocate or harvest but the transportation cost and the damage caused by the transportation will be compensated. Affected people will be compensated in cash at replacement cost at the time of land acquisition.

Detailed cost estimations to the affected households are as follows:

Table 5.2: Cost Estimation for Compensation

No.	Item	Amount (VND)
1	Compensation for land	4,157,258,000
2	Compensation for houses, architectural structures, and other assets	11,420,080,000
3	Compensation for trees	272,000,000
4	Compensation for agricultural products (rice)	193,698,000
5	Compensation for aquaculture value (one season)	553,457,100
6	Allowance	44,803,502,000
7	Implementation and management expenditures	1,227,999,902
8	Training and capacity strengthening	245,599,980
9	Independent monitoring	2,455,999,804
10	Contingency	6,532,959,479
	Total (VND)	**71,862,554,265**
	Total (USD)	**3,193,891**

(Source: Resettlement Action Plan)

* Compensation rate were built based on market survey and prices and consultation with affected persons. Of which allowances cost the most (VND 44,803,502,000) – making up 62% of the total. Allowances include: subsistence allowance, occupation transition allowance and job seekers' allowance, allowance for fishing tools (nets, pumps, aerators) for aquaculture-farming households, business allowance for the business households affected along drainage and sewer alignments, allowance to fix the works/ structures damaged by construction activities of the project, allowance upon acquisition of public land managed by the affected communes and wards, allowance for poor HHs, and allowance for the households that are under preferential treatment policy (the wounded soldiers and the revolutionary martyrs), and allowance for timely hand-over.

5.1.2 Mitigation of UXO Risks and Impacts from demolition and ground leveling for site Plan preparation

For mine clearance, the project has allocated VND 9,747,000,000 (US$ 443,045). The Project Owner will contract specialized army units to carry out the work before handing over the sites to construction contractors.

5.1.3. Measures to be Integrated into Subproject Detailed Design

During the feasibility and detail engineering design, the following environmental solutions and mitigation measures have been or will be incorporated in to the project proposals:

(i) Drainage and Wastewater Collection System, and Pumping Stations

- Choose the alignments of the pipelines following existing roads, footpaths taking into account the city relevant plans in order to minimize land acquisition and smooth connectivity with future investments;
- Include structures for erosion protection surroundings and at the bottoms of the outfalls;
- Sewerage system would be designed based on surveys on local hydrological regime (such as flood level, flow regime etc.), topography and geology to ensure effectiveness;
- Sewerage systems would be proposed to be designed with box culverts, CSO and anti-odor manholes where coming across residential areas;
- Pump stations located at public places would be designed to ensure safety and landscape beauty, with fences and warning signs;
- Different alternatives concerning the alignment and scope of the work items have been considered, and priority is given to those alignments which are likely to exert fewer or

negligible impacts such as crossing uncultivated land, agricultural land or public land with few residents, or those running along existing roads. At intersections with residential areas, different options have been considered, and necessary adjustments have been made so as to minimize the number of displaced people. The alternatives of reducing the designed width of roads or intersections have been introduced for analysis and consideration;

- Apply measures to ensure safety for pumping stations: cover and lock the pump chambers, closed and water-proof electrical panels, warning signs to ensure safety during operation phase of pumping stations, reinstatement of disturbed roads surface and footpaths included in engineering design and cost estimation. For the pump stations located at public places, designed will also be designed with landscaping, with fences and warning signs

(ii)Cau Rao River and Cong Muoi Bridge

- Design of the embankment ensuring continuity of landscape of the area by choosing appropriate design parameters (elevation, supplement facilities such as footpath, lighting and tree planting etc.) and materials used.
- Combine engineering with biological measures for protecting the embankment from erosion: grass will be planted in concrete-framed cells built on the top part of the embankment. Design of riverside road includes trees planting and lighting.
- Design of Cong Muoi suit the landscape for the city, fit in the urban landscape and provide smooth connection with Le Loi road. .

(iii) School and Public Toilets

School toilets:

- A roofed corridor connecting classrooms with toilets is provided to ensure safe access in rainy weather; pave the floor with non-slippery materials;
- Design of the building allows maximizing the use of natural lights for lighting and disinfection. Select environmental-friendly materials such as unburnt bricks, energy-saving electricity and water equipment;
- Ensure adequate ventilation for the toilets to mitigate odor during operation phase;
- The toilets include hand-washing sinks. Posters with messages related to handwashing and hygiene included in the design of the toilet building. Apply good landscape design to attract young students;
- Ensure accessibility for disable children;
- The school toilets will be designed to ensure aesthetic beauty, friendliness and safety for the pupils, and for children with disabilities and include: i) separate toilets for girls and boys; ii) inside locks; iii) antisloppy floor; iv) enough light; v) separate toilets for children with disability which include safe wheel chair access and wall mounted grab rail.

Public toilets

- Design of toilet building is in harmony with the surrounding landscapes;
- The design includes access and room for wheelchairs.

(iv)Le Ky and Tay Bridges and Road

- Design the junctions at the two ends to ensure safety for traffic. The junction with National Highway 1A (NH1A) and Quang Trung Road include side access and traffic signs to allow the traffic flows joining and separating smoothly and safely;
- Detail design include access for farmers and local residents from existing agricultural land to the proposed road;
- Design compensatory irrigation canal and waterworks affected by road construction to ensure continuity of the canal's service;

- Compensate for the landscape and the tree cut off by planting trees along the road dividers and footpaths with trees and energy-saving lamps;
- Rehabilitate and improve the landscape for the area in front of the martyr's cemetery;
- Design the bridge with sufficient width and height clearance for waterway transport in the Le Ky river (small fishing boats);
- Zebra crossing is provided for walkers and road instruction signals are designed for the disable;
- Road design include drains to prevent flooding during operation phase;
- Surface water drainage system, street lighting system and traffic signs will be designed to meet relevant requirements. Traffic systems and intersections with existing streets are designed with proper width so visibility and traffic safety are ensured when the constructions are put into operation.

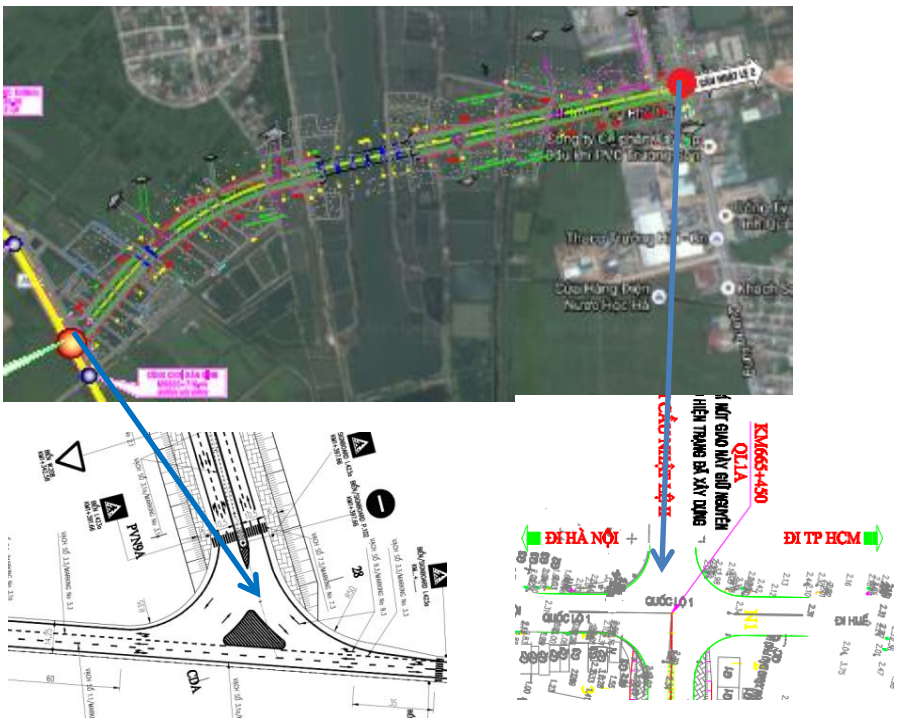


Figure 5.1: Road junctions at the two ends

5.2. MITIGATION MEASURES (ENVIRONMENTAL CODES OF PRACTICE) FOR GENERAL IMPACTS DURING CONSTRUCTION OF COMPONENTS 1 AND 2

As identified in Chapter 3, potential impacts and main risks which may occur during construction include: (i) Impacts from dust, exhaust gases, noise, offensive odors and vibration, (ii) Wastewater impacts, (iii) Solid waste, (iv) Hazardous waste, (v) Water pollution, (vi) Impacts on terrestrial and aquatic species, (vii) Impacts on urban beauty and landscape, (viii) Flooding, erosion and sedimentation impacts, (ix) Subsidence impacts, (x) Traffic safety issues, (xi) Impacts on infrastructural works and existing services, (xii) Social impacts, (xiii) Impacts on PCRs, (xiv) Community health and safety, (xv) Safety and health of workers, (xvi) Cumulative impacts.

The commonly accepted and widely applied Environmental Codes of Practice (ECOPs), which describe typical requirements to be undertaken by contractors and supervised by the construction supervision consultant during construction, will be used for addressing the typical impacts under Component 1 and 2 during construction and are presented below.

5.2.1 Mitigation of Impacts from Dust, Emission, Noise, Vibration, and Offensive Odors

The following measures will be implemented for dust, noise and vibration control:

- Maintain the level of emission at construction sites within the permissible limit provided for in QCVN 05: 2013/BTNMT: National Technical Regulation on Ambient Air Quality;
- Only use transportation vehicles with valid registry;
- Neatly gather construction materials and wastes. Arrange for the workers to collect and gather construction materials and wastes to the designated places at the end of each day or shift;
- Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25^{o}C, or in windy weather. Avoid overwatering as this may make the surrounding muddy;
- Do not overload the materials/soils and stones to extreme heights onto trucks, as this may result in drops along transportation routes. Tightly cover the trucks carrying wastes and bulk materials before getting out of construction sites or quarries and borrow pits so as to restrict scattering along transportation routes;
- Put temporarily gathered materials and waste heaps with a volume of about 20m^{3}within barriers or covered so as to avoid dust dispersion;
- Transport wastes out of construction sites to the designated locations for reuse or to the disposal sites in the soonest possible time;
- Burning waste will be prohibited at the construction sites;
- Do not put vehicles and machines to run idle in more than 5 minutes;
- Avoid preparation of construction materials such as mixing concrete near local people's houses or other sensitive works like pagodas, school gates, or offices;
- Locate vehicle washing stations at the exit/entrance of big construction sites such as the areas for WWTPs, regulation lakes, stormwater pumping stations and main pumping stations;
- Periodically wash the trucks used for transporting materials and construction wastes;
- Avoid construction operations generating great vibration and loud noise within the time between 6pm and 7am when construction takes place near residential areas. Night construction must be informed to the community at least 2 days in advance;
- Perform the method of successive construction for each sewer section in construction sites of long sewer lines;
- Observe and secure construction progress correctly;
- Set up 2.5m-high fences of corrugated iron around the construction sites such as the areas for the Cong Muoi bridge, Pumping station, Embankment and dredging Cau Rao river.

5.2.2 Wastewater Management

The Contractor will be required to be responsible to control the quality of surface runoff discharged from construction sites, to ensure that the effluent meets QCVN 08:2008/BTNMT – National Standard on Surface Water Quality. The Contractor shall ensure that:

- Toilets must have septic tanks for treating wastewater before it can be discharged into the environment;
- Mobile toilets or septic tanks toilets should be provided for the workers to use at centralised construction sites;
- Load construction materials in elevated sites to avoid flooding. Cover the piles of materials;

- Avoid temporary loading of excessive volume of construction materials at one time at construction sites;.
- Store excavated materials in designated areas approved by the Construction Supervisor only. Protect such storages to avoid direct contact with surface runoff;
- Minimise the quantity of fuel stored on-site. Fuel storage area must be at least 20 m from any water sources, roofed, fenced, on impermeable and bound ground for spill control;
- Do not maintain vehicles or replace oil on site. Collect and store wasted oil in plastic containers with lids; Place these containers on impermeable and bound surface for spill control;
- Locate workers' camps at least 10m from any surface water bodies;
- Provide adequate sanitation facilities, bathroom with proper drains for the workers to use. Wastewater must be collected and treated before being discharged into the environment. Ditches must be cleaned up periodically;
- Create and maintain sedimentation traps periodically to ensure that most solids in surface runoff are retained in the traps before entering the existing drains or water sources surrounding the site;
- Inspect, dredge, and clear the drains on site and the surrounding area periodically to prevent sedimentation and blocking;
- Wastewater from designated truck washing area, equipment washing etc. if any, must be collected and treated before being discharged into the environment;
- At completion of construction works, refill and seal safely the drains, ditch etc. soak pits and septic tanks, dismantle contractor's site office and any areas disturbed during construction, reinstate the disturbed areas d before handing over the site. Remove and transport to acceptable disposal site the soil contaminated with oil, if any;
- Set up toilets in the camp areas and large construction sites for the workers to use . There are separately toilets for male and female workers, one toilet room for every 25 workers. When construction is over, these toilets will be refilled and sealed safely;
- Domestic wastewater generated at workers' camps must be collected and treated before being discharged into the environment.
- Provide environmental training for the workers, including savings in natural resources used for construction

5.2.3. Waste Management

As discussed in Chapter 3, it is estimated that earthworks would generate a total of 96,815m^3 of dredged materials and excavated soil. It is planned that:

- 35,017 m^3 of excavated/dredged materials from Cau Rao river will be disposed of in Cau Cup landfill combined with recycling area which is 9 km from the city;
- Most of the remaining volume 61,798 m3 of excavated materials will be disposed of at the Cau Cup landfill, which is 9 km from Dong Hoi;
- 100,856 m^3 of top soil (50 cm on top) removed from rice field and Aquaculture land will be used for green space on the road later on. By doing so, while the top soil is reserved for beneficial use, energy consumption and emission would also being reduced as transportation distance is less.

Non-hazardous Waste Management

- Solid waste will be managed in accordance with Decree No. 59/2007/ND-CP dated 09 April 2007 on solid waste management and Decree No. 38/2015/ND-CP dated 24 April 2015 on management of waste and waste materials;
- Minimise the generation of garbage;
- Carry out waste separation at source;
- Promote reuse and recycling. Materials such as glass, wooden plates, steel, plastic, scaffolding material, site holding, packaging material, etc. shall be collected and separated for reuse for other projects or sold for recycling;
- Provide garbage bins at construction sites, site office and camps; The Bins shall be covered with lids, weather-proof and scavenger proof to avoid dispersion of bad odors, leachate leakage, attracting flies, mice and other vermin;
- Collect the waste and tidy up construction sites at the end of each working day/shift. Transport the waste out of the construction sites soonest possible;
- Collect all the wastes and residual materials and transport to the disposal sites by Quang Binh URENCO (licensed waste management contractor) or for use later;
- Make beneficial use of excavated soil. Dispose of the top soil (50 cm from ground level) removed from existing agricultural land in urban areas located within 10km from construction site for tree planting/greening purpose; Transport and dispose of other materials at the Cau Cup landfill (which is 9 km from Dong Hoi city) for covering the wastes later on; Dispose and landscape on-site the dredge materials from Cau Rao river (saline) or transport to Cau Cup landfill for final disposal.

Hazardous Waste Management

- All hazardous waste (waste oil and grease, organic solvents, chemicals, oil paints, etc.) must be temporarily stored, handled, and transported and disposed of in accordance with Circular No. 36/2015/TT-BTNMT dated 30 June 2015 by the Ministry of Natural Resources and Environment on management of hazardous waste;
- Transportation of hazardous waste off the site should be done in cooperation with an approved and authorized partner;
- Collect and store used oil and grease separately in specialized containers. Place these containers in safe and fire-free areas with impermeable floors, roofs, at a safe distance from fire sources;
- Return unused or rejected tar or bituminous products to the suppliers or producers.

5.2.4 Measures to Control water pollution

- The Contractor is responsible for controlling the surface water quality when discharging it out of the construction site, in accordance with QCVN 08-MT:2015/BTNMT – National Technical Regulation on surface water quality and QCVN 14:2008/BTNMT – National Technical Regulation on domestic wastewater quality;
- Store used and unused oil and petrol on impermeable ground covered with roofs, with warning (flammable and danger) signs, and contained within surrounding fences for easy control and collection in case of leakage. Locate oil and petrol storages areas at least 25m from any ponds, lakes, rivers, and streams. Restrict accessibility to this temporary storage, only to authorised persons can access;

- Perform concrete mixing on impermeable ground only, at least 20m from any water sources. Collect the waste and wastewater containing cement at the sedimentation traps and drainage ditches regularly to limit the amount of solids entering receptors;
- Maintain vehicles and replace the oil at designated workshops only. Do not perform these activities on-site;
- Collect and keep used/waste oil and materials polluted with oil/chemicals in containers, store in safe place (on impermeable ground, roofed, fenced and with warning signs) for regular collection by licensed dealers;
- Collect the waste and wastewater containing cement at the sedimentation traps and drainage ditches regularly to limit the amount of solids entering receptors;
- Provide sedimentation pits and ditches at big construction sites;
- Provide appropriate toilets for the workers to use;
- Avoid carrying out excavation and backfilling in rainy weather;
- Collect, gather and transport materials and waste generated during excavation and backfilling materials to designated site for reuse or final disposal at soonest possible;
- Temporary loading of construction materials or concrete mixing are allowed only at places which are at least 50m from any ponds, lakes, rivers, streams, or other water sources, or at maximum possible distances between the temporary loading locations and the canals;
- Collect and transport the excavated soil out of the construction site within 24 hours. Dredged materials must be transported away from temporary disposal sites as soon as they are dry enough;
- Carry out maintenance of vehicles and equipment, including oil replacement or lubrication in designated areas only. Ensure that no chemicals, petrol, oil, or grease are leaked into the soil, the drains or water sources. Use trays to hold the rags and materials used in maintenance. Collect and dispose of the wastes in accordance with hazardous waste management.

5.2.5 Measures to Control impacts on Terrestrial and Aquatic species

- Minimise the areas disturbed, especially in locations having trees or vegetation;
- Do not load materials and wastes at places having vegetation cover. Load them on barren land instead;
- If trees can be replanted somewhere, move them instead of cutting the trees down;
- If any invasive species are found during construction phase, burn them before disposed of to prevent them from regrowing at disposal site;
- Chemicals must not be used to clear vegetation;
- Maintain flow where possible to retain aquatic lives (More details are described in specific mitigation measures).

5.2.6 Measures to Control impacts on Urban beauty and Landscape

- Place the signboard “Sorry to disturb” at the construction sites located in popular area;
- Keep the disturbed areas to be minimal; re-establish vegetation cover as soon as construction is completed;

- All facilities are maintained in a neat and tidy condition and the site shall be kept free of litter;
- Fence the construction site with solid materials if the construction site is exposed to sensitive sites or exposed to tourist areas;
- Do not load construction materials or waste within 10 m from the gate of any public building or cultural structures such as government offices, temples, school etc;
- Collect and transport excavated materials and construction wastes to the disposal site within 24 hours;
- Clean up the construction site daily if the site is located in populated areas;
- Wash vehicles periodically to prevent dust dispersion onto roads;
- Dismantle the camps as well as other temporary works set up during construction and restore the site before the completed work could be handed over to the subproject owner. Back fill and tightly seal toilet pits, septic tanks, and temporary sewerage ditches;
- The Contractor will prepare construction plans in such a way as to avoid the 1st and 15th days of each lunar month if construction is to be carried out near historical and cultural institutions such as pagodas, churches, temples, etc.

5.2.7 Measures to Control Sedimentation, Erosion and Flooding

- Avoid disturbances and damage to the existing vegetation and green trees;
- Periodically and thoroughly remove soils, stones and wastes from drainage sewers and ditches inside and around the construction site;
- Neatly gather materials and wastes so as to limit them being swept away by stormwater;
- Carry out ground leveling and rolling after discarding materials at disposal sites.

Management of Flooding Risks

- Check the existing drains within and surrounding the construction sites, improve before levelling to ensure rainwater can be drained properly;
- Load construction material and wastes at least 10 m from any existing drainage ditches or water sources to minimise materials from entering the channels which may lead to sedimentation and blockage;
- Clean up the existing drains regularly.

Erosion and Sedimentation Control

- Transport the waste out of the site within the shortest time possible but this operation should not last more than 2 days;
- Install and maintain sedimentation traps within and/or surrounding centralised construction sites. Remove the soil, stone and waste periodically from the traps to maintain their functions;
- Gather the materials and waste neatly to limit the amount of materials being swept away by stormwater;
- Carry out levelling and rolling after waste disposal at the disposal sites in order to minimise erosion;

- Use Larsen sheet piles for protecting the walls/slopes when excavation is deeper than 2.5m. Reinforcing piles must be checked and maintained to ensure stability of excavated trenches and holes;
- Levelling the disturbed areas to prevent erosion;
- Strictly avoid disturbance or damages to the existing vegetation and trees.

5.2.8.Measures to Control Landslides and Subsidence

- Limit disturbances to construction areas, especially in locations currently with green trees or vegetation;
- Do not set up offices, camps, or temporary works on sloping areas;
- Use Larsen sheet piles for building prop walls when excavation is performed to a depth of 2.5m and more;
- Reinforce weak slopes and protect them with sandbags when there are high risks of erosion and landslides or in case of visible gully erosion;

5.2.9 Measures to Control Traffic and Traffic Safety

- Install and maintain sign boards, fences, signal lights to direct traffic to ensure traffic safety. Ensure adequate lighting at night time;
- Before transportation, trucks must be covered very carefully, materials must not be loaded to 10cm higher than the truck body so as materials are not dropped or scatter onto roads causing dusts dust and accident risks;
- Place speed limits signs at a distance of 100m from the construction site. Place additional signs if construction site is within 20 m from the gate of any schools, markets, hospitals, pagodas, densely populated areas, narrow roads, etc., arrange worker to guide the traffic in rush hours;
- Coordinate with the police for traffic diversions as necessary;
- Collect and tidy up the waste and wastewater containing cement at the sedimentation traps, ditches regularly to limit the amount of solids entering receptors;
- Avoid loading and unloading materials in rush hours;
- Only use vehicles with valid registration. Trucks must be covered to prevent materials from dropping along the routes to cause dusts and accidents;
- During construction near schools, staff must be deployed at the site to guide the traffic at the start of school time and when school is over. Water the roads to prevent dust, limit the speed of traveling trucks, horns should not be flared, and do not dispose waste and wastewater onto areas near schools;
- Do not park construction vehicles on the roads longer than needed. Vehicles should be parked only for loading/unloading materials and wastes;
- Provide additional hard sheets crossing open trenches/holes passing houses/shops as and when needed;
- Arrange staff/workers to assist young children and aged people crossing temporary access if possible
- Ensure temporary access for wheelchairs to affected households having disabled people if required;

- Plan and implement construction activities at night-time at locations where traffic is too busy in order to reduce traffic disturbance and traffic safety risks;
- Install night lighting at all construction sites.

5.2.10. Control of Impacts on Existing Services and Infrastructure Works

- Only use vehicles with sizes and loads within permissible limits set for the roads along such vehicles' route;
- Inform the affected households at least two days in advance when water or power is cut-off for construction;
- The Contractors shall be responsible for repairing, restoring all damages of the road, bridge due to overloaded transportation;
- Crane drivers should arrange workers to observe when operating with bulky items such as large pipes or cranes in order to avoid damages to electric lines or any other existing infrastructure nearby;
- Reinstate all disturbed or damages infrastructure including road surface and footpath;
- The Contractors will be responsible for repairing, recovering, and compensating at their own costs for all the damages caused to existing infrastructure at the contractors' faults;
- Reinstate the road surface and sidewalks disturbed by construction after construction has been completed;
- During the construction under power lines, deploy qualified staff to observe and give instructions to the drivers of cranes and excavators so as to avoid causing damages to power lines, telecommunications lines, etc.

5.2.11. Control of Social Impacts

- Contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on safety in construction;
- The contractor shall register the list of workers with the local authorities for temporary residence;
- The contractor shall inform the community about construction plan at least 2 weeks before commencement of the construction;
- In case electricity and water supplies are to be disrupted, the PMU must inform PAHs at least 2 days in advance;
- Avoid construction operations at night time. Where construction at nighttime is inevitable the community must be informed at least 2 days in advance ;
- Rolling/stagged construction methods shall be applied to pipeline installation packages. Construction should be performed within the shortest possible time, particularly at sections passing populated residential or business areas;
- Construction sites shall be kept tidy and safe;
- Wooden planks with adequate strength and width must be placed over the open ditches to provide temporary access to roadside houses and shops;
- Do not park construction vehicles on the roads in populated areas longer than needed. Vehicles should be parked only for loading/unloading materials and wastes; Keep duration of temporary storage of materials and wastes at the site to be minimal. Refill the pipetrench /open holes soonest possible.

- If visions to shops/businesses are blocked by construction activities, instruction signs observable from the main road will be provided.
- Provide additional hard sheets crossing open trenches/holes, arrange staff/workers to assit local people taking their motorbikes/goods in and out of the houses/shops as and when needed;
- Ensure temporary access for wheelchairs to affected households having disabled people if required
- Allowances are provided for 200 affected business households along the road. The allowance amount is VND 30,000,000 per household as per Decision 22/2014/QD-UBND Quang Binh, equivalent to 30% of one-year, tax-excluded average income;
- Hire local laborers to carry out simple tasks;
- Provide training to workers on the Codes of conducts and modes of communication with local communities which cover, but not limited to the followings:

  + Use adequate safety gear provided;

  + Smoke at designated places only. Do not litter construction sites;

  + Storing or use of weapons and toxic substances is prohibited;

  + Do not cut trees outside construction sites or set fire to waste on-site(except invasive plants);

  + Drinking of alcohol during working hours is prohibited;

  + Do not operate construction plant if not authorised to do so;

  + Do not engage in quarrelling, fighting, gambling or social evils such as drug use, prostitution;

  + Do not litter the sites and the surrounding areas

- Medical checkups for workers are to be periodically performed. People with highly infectious diseases shall not be employed.

5.2.12 Measures to Control the Impacts on Cultural Heritages

- When construction activities would be carried out near any cultural, historical sites such as pagoda, church, temple, , the contractor shall schedule construction plan to avoid the days that festival or special events may take place at these cultural sites such as the middle of lunar month, public holidays. When carrying out the works in such areas, the contractor shall implement good site management practice including regularly clean up the site regularly, load materials in a tidy manner, and transport wastes out of the sites as soon as possible;
- If artifacts, archeological sites, historical sites, remains and objects, including graveyards and/or individual graves are exposed during construction phase, the Contractor shall follow Chance Find Procedure described below:
  - Stop the construction activities in the area of the chance find;
  - Delineate the discovered site or area;
  - Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Department of Culture and Information takes over;

- Notify the Construction Supervision Consultant who in turn will notify responsible local or national authorities in charge of the Cultural Property of Viet Nam (within 24 hours or less);
- Relevant local or national authorities would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
- Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage;

- If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the Project's Owner will need to make necessary design changes to accommodate the request and preserve the site;
- Decisions concerning the management of the finding shall be communicated in writing by relevant authorities.

5.2.13. Measures to Secure Safety and Health for Communities

- The contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on labor safety in construction operations;
- In case of epidemic outbursts, the Project shall cooperate closely with the local government to carry out the required mitigation and control measures;
- Fence centralized construction sites with solid materials of at least 2m high;
- Place warning signs and fence the open pits, channels to prevent accident;
- Sufficient lighting will be provided when construction is carried out at night;
- Apply speed limits at 20km/h within 200m from the construction;
- Where possible, place machines generating high level of noise as far as possible from residential houses and public areas so as noise level and be kept below 70dBA;
- Use static compacting when the road base is constructed near areas with many households and weak temporary works to restrict vibration;
- The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers.

5.2.14. Measures to Ensure Worker Safety and Health

- Provide trainings to workers on environment, safety and health including raising awareness on HIV/AIDS and other infectious diseases;
- Provide adequate protective clothing and gear such as masks, helmets, boot/shoes, gloves, goggles, belts, life vest, lifebuoys, etc. (depending on each nature of work) and request the workers to use when working;
- Power lines, switches etc. must be installed and maintained safely at site-offices, construction sites and camps. Electrical cables must not be laid on the ground or water

surface. Electric wires must be with safe plugs. Outdoor electric panels must be placed in protection cabinets;

- Apply speed limits to vehicles traveling inside construction sites;
- Provide fire extinguishers, first aid kits, and medicine cabinets with medicines for common diseases in the locality at the site office and the camp;
- The workers' camp must be provided with clean water, electricity and mobile toilets. Workers' beds must be protected with mosquito nets;
- The camp, kitchen, bathing place and mobile toilets should be cleaned up and tidied up regularly and kept in good hygienic conditions. The flow of drainage ditches around the camp should be periodically cleared;
- Fuels and chemicals must be safely stored in areas with impermeable ground with roofs and surrounding banks, equipped with safety warning signs located at least 20m from the camps and at the end of prevailing winds;
- In the event that accidental leakage or spillage of diesel/chemicals/chemical wastes takes place, the following response procedures shall be followed immediately by the Contractor(s):
    - The person who has identified the leakage/spillage shall immediately check if anyone is injured and shall then inform the Contractor(s), Supervision Engineer and PMU;
    - The Contractor(s) shall ensure any injured persons are treated and assess what has spilled/ leaked;
    - Should the accidents/ incidents generate serious environmental pollution (e.g. spillage / leakage of toxic or chemicals, large scale spillage / leakage, or spillage / leakage into the nearby water bodies, the Contractor shall immediate inform PMU;
    - In such cases, the Contractor(s) shall take immediate action to stop the spillage / leakage and divert the spilled / leaked liquid to nearby non-sensitive areas;
    - The Contractor(s) shall arrange maintenance staff with appropriate protective clothing to clean up the chemicals/chemical waste. This may be achieved through soaking with sawdust (if the quantity of spillage/leakage is small), or sand bags (if the quantity is large); and/or using a shovel to remove the topsoil (if the spillage/leakage occurs on bare ground); and
    - Depending on the nature and extent of the chemical spill, evacuation of the activity site may be necessary;
    - Spilled chemicals must not be flushed to local surface drainage systems. Instead, sawdust or sandbags used for clean-up and removed contaminated soil shall be disposed of by following the procedures for chemical waste handling and disposal already described;
    - The Contractor(s) shall prepare a report on the incident detailing the accident, clean up actions taken, any pollution problems and suggested measures to prevent similar accidents from happening again in future. The incident report shall then be submitted to the Supervision Engineer and PMU for review and keep in the records. The incident report shall also be submitted to DONRE, if required;
    - In case occurring the accident, the contractor should immediately cease the execution, take the first aid to the victim then to move to the nearest medical firm, to report the supervisor and investor.

5.2.15. Hazard Risk Management

- Electrical lines will be arranged in a safe manner, no wires will be place on the ground or without proper plug. Electrical panel placed outside must be protected from weather and for safety;
- Oil, fuel and chemicals will be stored at least 10 m from workers' accommodation and Contractor's Site office. These hazardous must be stored on water-proofed floor, bound and roofed. Warning signs must be placed at that storage area;
- In the event that accidental leakage or spillage of diesel/chemicals/chemical wastes takes place, the following response procedures shall be followed immediately by the Contractor(s):
    - The person who has identified the leakage/spillage shall immediately check if anyone is injured and shall then inform the Contractor(s), Supervision Engineer and PMU;
    - The Contractor(s) shall ensure any injured persons are treated and assess what has spilled/ leaked;
    - Should the accidents/ incidents generate serious environmental pollution (e.g. spillage / leakage of toxic or chemicals, large scale spillage / leakage, or spillage / leakage into the nearby water bodies, the Contractor shall immediate inform PMU;
    - In such cases, the Contractor(s) shall take immediate action to stop the spillage / leakage and divert the spilled / leaked liquid to nearby non-sensitive areas;
    - The Contractor(s) shall arrange maintenance staff with appropriate protective clothing to clean up the chemicals/chemical waste. This may be achieved through soaking with sawdust (if the quantity of spillage/leakage is small), or sand bags (if the quantity is large); and/or using a shovel to remove the topsoil (if the spillage/leakage occurs on bare ground);
    - Depending on the nature and extent of the chemical spill, evacuation of the activity site may be necessary;
    - Spilled chemicals must not be flushed to local surface drainage systems. Instead, sawdust or sandbags used for cleanup and removed contaminated soil shall be disposed of by following the procedures for chemical waste handling and disposal already described;
    - The Contractor(s) shall prepare a report on the incident detailing the accident, clean up actions taken, any pollution problems and suggested measures to prevent similar accidents from happening again in future. The incident report shall then be submitted to the Supervision Engineer and PMU for review and keep in the records. The incident report shall also be submitted to DONRE, if required;
    - In case an accident occurs during execution of works, the contractor should immediately cease the execution of the works, apply first aid to the victim and then transport the victim to the nearest hospital or medical clinic and report the accident to the supervisor and investor.

5.2.16. Some Mitigation Measures Implemented under the CCESP

Below are some photos illustrating mitigation measures applied during the construction phase of the CCSEP project – Dong Hoi city sub-project

Warning signs and the barrier at drain construction sites at densely residential areas

Road lane separation for road construction at non-residential areas

Road lanes are separated to avoid traffic disruption and separation barriers are provided

Temporary access bridges for local people during drain construction

Service roads and work camps are arranged independently, being separated with transport roads by walls; thus, no environmental impacts and traffic obstruction risks

Road cleaning and reinstatement upon construction completion

Larsen sheet piles are deployed to prevent land slump during drain construction

Safety fences for PS construction sites

Signs and barriers are provided for road construction sites

Safety fences during road excavation for pipe laying

Construction site board at Duc Ninh WWTP

Walls separating construction sites with local houses and traffic participants

5.2.17. Type-specific Mitigation Measures

5.2.17.1 Drains and Sewers

Excavation for pipeline installation will be implemented in stages, following the rolling method:

- Before construction commencement, carry out field survey to identify the existing weak structure or permanent structures but at risks of being cracked/collapsed due excavation for pipeline construction/installation, take photos and make record. Propose appropriate construction method and special mitigation measurs to avoid or fully address the risks.
- Ensure construction quality control and roadsurface reinstatement after backfilling and compaction so as the ground is not sink/collasped after construction is completed
- Minimise carrying out construction activities and arrange staff to guide traffic during peak hours from 7 am to 8 am and 4 pm to 6pm
- Apply speed limit at 10km/h at sites, arrange staff to guide traffic where the pipes or wastes are being loaded, unloaded or placed into the trench
- Put and maintain bulletin boards at the construction site containing the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work;
- During drain construction at roads where there are offices, schools, and business households, temporary access must be provided over excavation trenches to ensure safety, especially for pupils and business households;
- Allowances are provided for 200 affected business households along the road. The allowance amount is VND 30,000,000 per household as per Decision 22/2014/QD-UBND Quang Binh, equivalent to 30% of one-year, tax-excluded average income;
- Successive construction will limit impacts on daily activities and business of the local people living along the alignments;
- Develop and implement a plan for successive construction, with each 50m section for the wastewater sewers and 300m for the stormwater sewers;
- Restore the site of each completed construction within 24 hours. In sections to be asphalted, asphalting must not exceed 3 weeks from the date of site restoration. After stormwater drainage lines are installed, carry out backfilling immediately in accordance with the technical design requirements before starting excavation for the next section;
- Put fences, sign boards, warning boards, beacons, and barriers along the ditches and roads under construction in accordance with current regulations. Place the sign boards with writing "Sorry for any conveniences caused" in densely populated areas with many restaurants, hotels, etc;
- Deploy staff to watch for the traffic and give instructions and warnings, especially when vehicles come in and out of the construction sites or stop for loading and unloading of materials and waste;
- Neatly gather materials and wastes, avoiding encroachment on existing roadways, sewers, and drainage manholes. Collect thoroughly the excavated soil falling in existing stormwater manholes and drains;
- Immediately transport the excavated soils to the designated areas outside the construction sites;
- Coordinate with the relevant authorities before the sewers crossing the streets to arrange for traffic channelization if necessary. In case the construction area would take up only 50% of the road width, carry out the construction activities in one half of the pavement, with the other half reserved for vehicle circulation. Carry out construction of the road-crossing

sewers at the times of light traffic as at night, during which lighting must be properly provided;

- Avoid construction activities that may generate loud noise at noon, midnight or in the early morning, in areas near residential areas. If construction is planned to be carried out at night, inform the community at least 2 days in advance;
- Clean the construction sites and tidy up after every construction session;
- Install temporary access to give access to roadside houses and shops, affected by ditch excavation;
- Use wall piles in the excavated pits and ditches with a depth of 2.5m and over. Check the bearing walls and reinforce to ensure the stability of the excavated pits;
- Fence the CSOs to avoid fall of people, especially the children;
- Backfill the excavated ditches and pits and reinstate the pavements in the soonest possible time;
- For tertiary sewers to be located in alleys, provide temporary walkways or ground surfaces, do not gather materials, and do not use large-sized construction vehicles and means in such areas.

5.2.17.2.Mitigation Measures for Construction of Pumping Stations

- Place and maintain bulletin boards at the construction site, containing the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work;
- Place corrugated iron enclosures with a minimum height of 2m around the construction site;
- Fence off the construction sites by iron sheets 2m high to ensure safety for people;
- Place warning signs of construction site, deep pits, and speed limits on the section passing the construction site;
- Use Larsen sheet piles to prevent wall slumping;
- Gather materials and excavated soils around foundation pits and properly monitored to ensure minimum scope of disturbance;
- Collect wastes and construction materials within 20m around pumping stations every day;
- Provide ladders for workers for safe access to and operations in deep pits.

5.2.17.3 Dredging and Embankment Lining of Cau Rao River

- Avoid dredging in the rainy season, from September to December, in order to maintain drainage function of the river;
- The Contractor shall prepare a Contractor's Dredging Management Plan (CDMP) and submit to the Supervision Consultant and PMU for review and approval before carrying out the works. The dredging plan shall indicate clearly:
  - The Scope of Works in the Contract package, dredging method and schedule,
  - Water users that may be affected by the dredging and embankment lining
  - the dredging volume, water quality and the characteristics of dredged materials; particularly water should be tested for pH,DO, TSS, BOD, salinity etc. ; heavy metals including pH, Hg, As, Cd, Cu, Pb, Zn and Cr, Organic Materials and

Mineral Oils must be tested for sediment. one sample of water and one sample of sediment sample must be taken and tested for each contract package

- Process for temporary storage of dredged materials and plan for pollution control on-site
- Materials uploading and transportation method to the final disposal site: indicate proposed route of the transport from the dredged site to the disposal area, time of operation, type of vehicles/trucks
- Schedule to inform the nearby communities about the project, disclosure of name and contact number for possible complaints.
- Potential social and environmental impacts, including the site-specific impacts and risks of dredging
- Mitigation measures to address the potential impacts and risks.
- final disposal plan;
- Environmental monitoring plan.

- In addition to relevant mitigation measures for common construction impacts, the dredging plan shall meet the following requirements:
  - Coffer dams are built before dredging to separate the construction site with the remaining sections of the Cau Rao river;
  - Disturbance to the ground and on riverbed is kept at minimal; Monitoring is carried out regularly ensure temporary storage of dredged materials in abandoned aquaculture pond would not cause pollution to the surrounding; sedimentation trap is installed surrounding these ponds;
  - Brackish wastewater leaked from dredging materials will be led to flow back into the Cau Rao river;
  - During dredging time, since the flows are low, pipes will be used to direct the runoff discharged from the existing balancing lake and seven stormwater drains to the downstream of the Cau Rao river;
  - When storm is forecasted, dredging or embankment lining activities will be limited, site protection measures are implemented; all construction activities will be halted in stormy weather ;
- Dredging equipment must be operated at slow speed in intervals to allow sedimentation;
- Provide warning signs at dangerous areas, for example, underflows, erosion points, or deep excavation;
- Specified safety equipment such as lifebuoys are provided to the workers and force the use when working in the water. Assign observers throughout work shifts for timely rescue in case of emergency;
- Dai Giac pagoda is located 200m from the dredging area and is a sensitive receptor. Construction schedule should plan to limit construction activities on the first and the full moon days of lunar months; tidy up the site regularly, spray water to mitigate dust at least twice a day in hot and rainy day, do not park construction plants or load materials within 50 m from the pagoda gate. Workers should be informed about the requirements to limit impacts to the pagoda;
- Wet dredged sediment with salinity of 10.‰ will be stored temporarily at the abandoned aquaculture ponds adjacent to the dredging section (as illustrated in Figure 1.10). Each pond is 500m^2 large, 1.5 m deep, 750m^3 in capacity. Before storing the dredged sediment, the Contractor shall dry the pond by pumping the water into the river, and

create path for leakage water to go back to the Cau Rao river. After 3-5 days in the lake, dredged sediment will be transported to Cau Cup disposal site;

- Saline dredged materials and soil will be disposed of in a separate areas at the Cau Cup landfill; the bottom and the surroundings of the disposal areas shall be lined with impermeable materials, surface runoff is led to the existing drains so as it can be diluted before entering waterbodies;
- When salinity in the dredged materials (at 30 cm deep) is reduced to below 2‰ (at which most plants can tolerate), apply top soil at least 30 cm thick and plant trees on the top.

Figure 5.2: Temporary Storage Area for Dredged Sediments at Cau Rao River

(Dredged Materials Management Phan are presented at Annex 07)

5.2.17.4 Bridge Construction

- The bridge works shall be scheduled to avoid the high river flow season;
- The PMU and the Contractor shall co-operate with Electricity Company and water supply companies for relocation of the existing 24KV electric poles at the two ends of the bridge and the existing water supply pipelines which is 2m from the bridge;
- The Contractor shall be required to prepare specific Environmental, Health and Safety Plan (EHSP) before the demolition of the existing bridge and construction of the new bridge. At minimum, the EHSP shall satisfy the following requirements;
    - Descriptions on measures for spill prevention, and sedimentation control, surface water flow diversion, reinstatement, etc;
    - Local people shall be informed about the block off and demolition of the existing bridge with at least two weeks notice;
    - Signboards and fences shall be placed and maintained to safely block off access to the two ends of the existing bridge. Allocate staff to guard the site 24 hours per day. Ensure adequate lighting at night time;
    - Signboard directing traffic diversion shall be installed in 23-8 Road (600m from Cong Muoi bridge) before the existing Cong Muoi bridge is blocked off for demolition and reconstruction;
    - Life vests and protective equipment are provided to the workers and enforce the use when working in or above water surface, especially during construction of bridge abutments (2-3m high above the water surface);
    - For bridge construction, the waste shall be controlled strictly to restrict discharge or dumping of any wastewater, slurry, waste, fuels and waste oil into the water. All these materials must be collected and disposed of on land at the banks. The

slurry and sediment shall also pump to the banks for disposal and shall not be allowed to discharge to the rivers directly;

- Reinstatement of watercourse crossings;
- After bridge construction, the works area shall be reinstated;
- Concrete mixing directly on the ground shall not be allowed and shall take place on impermeable surfaces;
- All runoff from batching areas shall be strictly controlled, and cement-contaminated water shall be collected, stored and disposed of at the approved site;
- Unused cement bags shall be stored out of the rain where runoff won't affect it; Used (empty) cement bags shall be collected and stored in weatherproof containers to prevent windblown cement dust and water contamination.;
- All excess concrete shall be removed from site on completion of concrete works and disposed of. Washing of the excess into the ground is not allowed. All excess aggregate shall also be removed;
- Specific mitigation measures shall be applied to minimize the potential impacts on the Dai Giac pagoda (located 200m from Cong Muoi bridge): cover and wet the demolishing area to prevent dust, the wastes shall be transported to a disposal site within 24 hours; no demolishing activities allowed on the first and the full moon of lunar months, a workers' camp must be as far as possible and not less than 300m from the pagoda. The service road passing the pagoda must be clean up every day, water must be sprayed at least twice a day in hot day, and construction plant and vehicles are prohibited from parking within 20 m from the pagoda gate.

5.2.17.5. School Sanitation and Public Sanitation Facilities

- Put and maintain bulletin boards at the construction site, containing the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work;
- Inform the school boards of directors in advance of the construction plan to cooperate in management of school students, security, and safety during construction;
- Assign security guards around the construction sites so as to warn pupils in due time against approaching the construction site;
- Place fences around the work site and place warning signs on the fence; water the existing sanitation blocks before and during demolition to limit dust;
- If possible, provide separate entrances and exits for waste and material trucks;
- Schedule demolition of the existing toilets beyond study hours. Fence off the construction site with iron sheet of 2m high to limit dust and ensure safety for the school children;
- Avoid activities generating great noise or vibration such as demolition of concrete structures or driving of piles during class hours;
- Collect any wastewater generated by the construction to a settling tanks before discharging to the outside of the school;
- Schedule trucks transporting waste and materials not to enter and exit the school before the start of class hours, during school time, or just after class hours;

- Gather materials and wastes neatly during construction and dispose the wastes at the designated site within the soonest possible time and within less than 24hours;
- During construction, the contractor will be requested to shield off the site with fence walls to mitigate impacts on the school environment and safety of both teachers and pupils. Corrugated iron fence walls of 2.5m wide must also be set up to shield off the construction site for public sanitation facilities to minimize impacts on visitors and locals pedestrians entertaining themselves in the park;
- The construction site area must be tidied up daily. Only small capacity machines and equipment with low noise level generation should be used;
- Warning signs are to be placed to prevent pupils from approaching the construction site;
- Construction plans should be scheduled during school summer vacation time if possible in order to limit negative impacts on pupils and teachers.

5.2.18 Site-Specific Mitigation Measures

5.2.18.1 Disposal Sites

It is planned that excavated and dredged materials of the project will be disposed at Cau Cup landfill (a closed landfill, reclaimation has been being planned. The Cau Cup landfill has been being managed by the umbrellar Company in which the PMU is part of). The following measures shall be complied with during disposal process of the project:

- Post a speed limit sign at the entrance of the disposal site;
- Provide a notice stating "Only authorized persons are allowed", limiting access by unauthorized persons to the disposal site;
- Provide truck washing area at the entrance gate. Wash or clean truck bodies before trucks leave the disposal site to ensure that no residual wastes can scatter out in roads;
- After being tipped down, disposal waste piles must be levelled and rolled out to mitigate dust emission, erosion, and washing off by wind and water as well as to limit safety risks;
- Mark clearly natural drainage areas to avoid waste disposal at such areas and to protect the ditches from being damaged or disturbed;
- As full closure of the Cau Cup has been in planning stage, the PMU will arrange for a specific area for the disposal of 13,214 m3 of saline excavated/dredge sediment of Cau Rao river (at 10.8‰). The specific location will be determine by the landfill closure engineer based on the overall layout of the landfill. Disposal of the saline materials at the landfill will comply with the following principles:
    - The dredged materials will be isolcated from the surroundings to prevent uncontrolled spreading of salinity into vegetated land and groundwater (isolation can be provided by. waterproof materials such as plastic canvas.
    - Ditches will be created surrounding the specific disposal site. Runoff passing the dredge materials will be led to the common existing drainage of the landfill so as salinity can be dilluted before reaching the receptor.
    - water coming from the cell will be led to the existing drainshall be used to cover the bottom and the surroundings of the designated sediment disposal area. ditches will be built surrounding the disposal area of this
    - When disposal of dredged materials is completed, a layer of 50-60cm thick of excavated soil will be applied on top of excavated soil shall be provided on top of the excavated sediment to mitigate salinity spreading via stormwater overflows which, in turn, can limit development of the floral system at the disposal site. Create and maintain drainage path for the site so as subsurface runoff (brackish) can be diluted by the runoff incoming from the other parts of the landfill.

(although the exact location, the height and the dimensions of the land area where sediments are disposed off has not been determined, assuming disposal height is 3 m then 0.44 ha of land (which accounts for about 3% of the Cau Cup landfill's total land area) will be needed for disposal. Contributing 3% of total volume, after being diluted with the remaining 97 % of surface runoff from the cathment of the existing drainage, salinity in the combined flow would be negligible.

5.2.18.2 Along the Pipelines Alignment

ECOP and the common mitigation measures listed in section 5.2.17.1 will be applied for all pipeline installation packages. Additional measures for specific roads are listed in the table below.

Table 5.3: Site-specific mitigation measures by Drainage Route Locations

No.	Road	Issues/Impacts	Mitigation measures
1	Ly Thai To road	▪ Traffic disturbance because the 4.5m will be occupied on this 12m wide road. ▪ There are businesses and shops at road sides; ▪ Dong Son primary school and Con market; ▪ Land slide risk as excavated depth is 4.3m	▪ Avoid loading construction materials and waste within 20m from school gate; ▪ Remove the waste from the site in parallel with excavation/pipe installation; ▪ Place warning signs and speed limit at 10 km/h at section passing the market ▪ Clean up the road at end of working shiftswater the road section passing the school and market before peak hours: 7am, 11 am and 4 pm ▪ .
2	Le Hong Phong road	▪ Traffic disturbance and increased safety risks as the available roadwidth is reduced from 9 m to 4.5m (in sparsely distributed population area) ▪ Dong Son No. 1 primary school;	▪ Avoid loading of materials, equipment and wastes, park vehicles or concentrations of workers within 20m from school; ▪ water the road section passing the school before peak hours: 7am, 11 am and 4 pm
3	Ton That Tung road (Nam Ly)	▪ Traffic disturbance and increased safety risks (available road width is reduced from 8 m to 4.2m); ▪ Populated area, with retail shops along two road sides; ▪ Vietnam - Cuba hospital;	▪ Apply speed limit at 10km/h at sites where the pipes or wastes are being loaded/unloaded or unloaded ▪ Minimize construction at populated areas, school and hospital in peak hours ▪ Avoid loading of materials, equipment and wastes, park vehicles or concentrations of workers within 20 m from the gate of the hospital. ▪ No construction at lunch and night time.
4	Trung Truong road	▪ Traffic disturbance because the road width required for construction is 4.5m; the remaining road width is 12m; ▪ There are business and shops at road sides;	▪ Minimize construction time at populated areas, market; ▪ Remove the waste from the site in parallel with excavation/pipe installation; ▪ Clean up the road at end of working shifts ▪
5	Ngo Gia Tu road	▪ Traffic disturbance because the 3.8m will be occupied on this 6m wide road.	▪ Remove the waste from the site in parallel with excavation/pipe installation; ▪ Clean up the road at end of working shifts

		▪ There are business and shops at road sides; ▪ Land slide risk as excavated depth is 3.35m	
6	Huu Nghi road	▪ Traffic disturbance because the 3.8m will be occupied on this 22m wide road. ▪ There are the DONRE, the Fire Station, and Huu Nghi hospital at road sides;	▪ Minimize construction at peak time at populated areas, station, hospital; ▪ Avoid construction activities at peak hours ▪ Avoid loading of materials, equipment and wastes, park vehicles or concentrations of workers within 20m from the DONRE, fire station, hospital; ▪ Remove the waste from the site in parallel with excavation/pipe installation; ▪ Quickly remove all materials that may obstruct the movements of fire fighting trucks in case signals started in their station
7	To Huu road	▪ Traffic disturbance because 3.8m will be occupied on this 12m wide road. ▪ There is crowded population, food stalls/ restaurants, Nam Ly bus station at road sides;	▪ ▪ Water the road at least three time a day ▪ Avoid loading of materials, equipment and wastes, park vehicles or concentrations of workers within 10 m from restaurants and bustation ▪ Clean up the road at end of working shifts
8	Le Truc road	▪ Traffic disturbance because the 3.3m will be occupied on this 7m wide road. ▪ There are Hoa Hong kindergarten and the City People's Committee at road sides;	▪ Complete construction work earliest possible at the section passing the CPC office ▪ Minimize construction at peak hours 7 am to 7 am and 3 pm to 6 pm at at kindergarten and the City People's Committee; ▪ Avoid activities that generate high noise at lunch time 11am to 1 30 pm within 20 m from the kindergartenDo not load construction materials or park vehicles, do not use horns within 20m from the kindergarten and the City People's Committee; ▪ Remove the waste from the site in parallel with excavation/pipe installation.
9	Phan Dinh Phung road	▪ Traffic disturbance because the 4.5m will be occupied on this 12m wide road. ▪ There are shops at road sides; ▪ Bac Ly No. 1 primary school and Bac Ly No. 1 secondary school	▪ Do not load construction materials within 20m from Bac Ly schools; ▪ Clean up the road at end of working shifts ▪ Minimize construction at peak hours 7 am to 8 am, and 4 pm to 6 pm; avoid activites generating high noise during 11 am to 1 pm at the section passing the school ▪ Avoid activities that generate high noise during classroom hours at the section passing the school, These can be done during break time within school ▪ water the road section passing the school before peak hours: 7am, 11 am and 4 pm ▪ Do not load materials, and waste, park vehicles within 20 m from schoolRemove the waste from the site in parallel with excavation/pipe installation.

10	Hoang Dieu (Nam Ly) road	▪ Traffic disturbance because the 4.5m will be occupied on this 8m wide road. ▪ There are HHs and shops at road sides.	▪ Clean up the road at end of working shifts ▪ Remove the waste from the site in parallel with excavation/pipe installation.
11	Le Loi road	▪ Traffic disturbance because the 3.8m will be occupied on this 20m wide road; ▪ There are HHs and many shops at road sides; ▪ Dong Hoi General Hospital and Dai Giac Pagoda.	▪ Minimize construction at peak and sensitive hours7 am to 8 am, and 4 pm to 6 pm at populated areas, Hospital ▪ Avoid activities that generate high noise ▪ Schedule construction to avoid carrying out the section passing the Pagoda on 1st and 1th lunar month or their main festival ▪ Install fence to stop direct view from the pagoda to the construction site; ▪ Do not load construction materials within 20m from the gates of Hospital and Pagoda; ▪ Remove the waste from the site in parallel with excavation/pipe installation.
12	Sub-zone 9, Bac Ly	▪ Traffic disturbance because the 4.5m will be occupied on this 6m wide road. ▪ There are business and shops at road sides; ▪ soil subsident risk as excavated depth is 3m.	▪ Clean up the road at end of working shifts ▪ Remove the waste from the site in parallel with excavation/pipe installation;
13	Phan Huy Ich road	▪ Traffic disturbance because the 3.3m will be occupied on this 4m wide road; ▪ There are HHs and many shops at road sides;	▪ Diverting traffic flows to Diem Tan, Tran Nhat Duat, and Phan Phu Tien roads; ▪ Remove the waste from the site in parallel with excavation/pipe installation. ▪ Clean up the road at end of working shifts
14	Tran Nhat Duat road	▪ Traffic disturbance because the 3.3m will be occupied on this 8m wide road; ▪ There are HHs and many shops at road sides;	▪ Remove the waste from the site in parallel with excavation/pipe installation. ▪ Clean up the road at end of working shifts
15	Nguyen Van Troi road	▪ Traffic disturbance because the 3.3m will be occupied on this 6m wide road; ▪ There are HHs and many shops at road sides.	▪ Remove the waste from the site in parallel with excavation/pipe installation. ▪ Clean up the road at end of working shifts
16	Truong Phap road	▪ Traffic disturbance because the 2.5m will be occupied on this 15m wide road. ▪ There are many restaurants, and hotels at road sides; ▪ Nhat Le beach;	▪ Fence off construction sites with solid fence to stop the views from outsiders ▪ Place “access restricted” and “sorry to disturb” signboards at the construction sites ▪ Remove the waste from the site in parallel with excavation/pipe installation;.

5.2.18.3 Specific Mitigation Measures for the Road and Bridges under Component 2

In addition to the obligations to implement the common mitigation measures, the Contractor shall be required to prepare a Site-specific Environmental Management Plan (SEMP) covering environmental, health and safety aspects and submit to the Supervision Consultant for approval before construction commencement. At minimum, the ESMP shall satisfy the following requirements:

- Construction Schedule and Method;
- Materials and waste management: Measures to manage top soils removed from agricultural land along the alignment (for beneficial use if possible), and filling materials to prevent impacts on agricultural land;
- Measures to mitigate the potential environmental impacts, pollution control measures ;
- Provisions of accessibility for the farmers to the remaining agricultural/aquaculture ponds at roadside;
- Maintenance of irrigation service and compensation/reconstruction/repair of affected waterworks facilities;
- Traffic management ;
- Health and Safety management;
- Reinstatements of areas and facilities disturbed by construction.
  Site-Specific Mitigation measures along the alignment

Table 5.4: Site-Specific Mitigation Measures for Component 2

Km	Issue/Impacts	**Mitigation Measures**
0	Beginning point is connected with Quang Trung Road: traffic safety risks 	▪ Place project information board at the junction ▪ Place signboards “Work in progress” and “Speed limit 10 km/h) at the beginning point
50 m	Phu Hai ward’s cemetery is 50m from the road: + Visual impacts, landscape + physical cultural resources + impacts on vegetation cover and trees + Worker’s camps and temporary storage areas will be placed on part of the vacant land in front of the cementer 	▪ Separate the construction/camp areas with solid fences ▪ Maintain access to the gate of the cemetery ▪ Do not park construction plants or load materials, wastes within 10 m from the gate ▪ Avoid damages caused to the trees, reinstate vegetation cover ▪ Limit construction work on 1st and 15th lunar month ▪ Wastewater from camp will be led though closed pipes to irrigation canal ▪ SEMP and workers codes of conducts strictly applied
	Chu Văn An school is 200m from the road: + Traffic and Safety + Noise and dust 	▪ Arrange workers to direct traffic at peak hours at the turning point to the school ▪ Strictly manage the areas within 10 from turning point to the school: + Avoid parking and loading materials

Km	Issue/Impacts	Mitigation Measures
		+ Load material neatly and clean up the area daily
60 m	The road cut through abandoned rice field, some garbage and waste are dumped there Some houses at the far end 	▪ Keep disturbed areas minimal ▪ Store top soil separately for reinstatement of disturbed areas; transport the garbage to landfill site
0+300m	The road cut through the rice field 	▪ Inform local community about site clearance plan so as they can plan for crop harvesting before construction commencement ▪ Store and reuse topsoil for beneficial use
	A feeder canal (cross section of 1,0m) and casuarinas trees, 4-5m high, will be affected by land acquisition. 	▪ Build replacement canal before cutting off the existing canal ▪ Inform local community about site clearance plan so as they can plan for using the trees for beneficial use ▪ Prevent materials from falling into the remaining and replacement canal during construction, clean up the affected section regularly
	Mimosa Pigra, an invasive plant species presence in this area. 	▪ Mimosa must be uprooted, burnt on-site, seal the ash and disposed of separately at the landfill. ▪ The excavated soil from areas where mimosa is observed must be transported away immediately, temporary storage near existing agricultural land is not allowed
0+395m	The road cut through abandoned aquaculture pond 	▪ Maintain existing drainage pattern surrounding the pond to ensure no localized flooding during construction phase; ▪ Minimize clearance area and avoid damages to the trees;
	The road cut through the main 20 m wide earthen irrigation canal + disturbance to irrigation service + Drainage function may be affected + some trees along the canal 	▪ Build replacement canal before cutting off the existing canal; ▪ Build, maintain drainage pattern surrounding the construction area to ensure no localized flooding during construction phase; ▪ Minimize clearance area and avoid damages to the trees.

Km	Issue/Impacts	Mitigation Measures
0+500m	The road crosses the earthen irrigation feeder canal 	▪ Build boxed drain 150x150 reinforced concrete (to maintain irrigation service) before road construction; ▪ Manage material and wastes to avoid sedimentation caused to the existing canal
	The road crosses the aquaculture ponds 	▪ Compensate the affected households before construction ▪ Inform the affected households about construction schedule earliest possible ▪ Minimize the potential impacts on the trees and vegetation cover to maintain green landscape as much as possible
0+600 m	Starting point of the access to Le Ky Bridge, the road crosses Le Ky embankment with an existing path for pedestrians.  Camp and temporary storage area on vacant at riverside (available space very limited) 	▪ Maintain accessibility on the existing path during construction phase ▪ Store materials and construction plants safely in rainy season ▪ Do not park heavy construction plant too close to dyke slop that may cause landslide/damages to the dyke ▪ untreated wastewater will not be discharged directly into the river
0+700 m	Le Ky Bridge, 212m long, 30m wide, 6 spans (7 piers), each span is 33m long, the bridge's width is 30m. 	▪ Inform local community about the construction plan ▪ Implement SEMP and specific measures applicable to bridge, including ensuring safety on waterway transport (small fishing boats) ▪ Do not store materials, fuel within 20m from the river ▪ Do not wash equipment in the river
0+800 m	The road cuts through aquaculture ponds outside the embankment of the Le Ky river. 	▪ Compensate the affected households before commencement ▪ Inform the affected households about site clearance and construction plan as soon as possible so as they can plan and harvest the last crop in a timely manner
0+ 900m	The road crosses the abandoned lagoon located between Cau Tay and Ky river. 	▪ Build drains under the road to maintain drainage function between the two side of the lagoon

Km	Issue/Impacts	Mitigation Measures
0+ 1200m	The road cuts through rice fields intersected with aquaculture ponds 	▪ Maintain access to the remaining agricultural land during construction ▪ Prevent construction materials and wastes from falling into rice field and aquaculture pond ▪ Minimize disturbed areas
0+ 1300m	The location of planned West Bridge with one span, 24m long and 21m wide. Lots of mimosa pigra are found in this area. 	▪ If mimosa is presence at the disturb area, they must be uprooted, burnt on-site, seal the ash and disposed of separately at the landfill. ▪ The excavated soil from areas where mimosa is observed must be transported away immediately, temporary storage near existing agricultural land is not allowed ▪ Do no store materials, fuel within 20m , from the river ▪ Do not wash equipment in the river
0+ 1340m	The road crosses aquaculture ponds 	▪ Maintain access to the remaining agricultural land during construction ▪ Prevent construction materials and wastes from falling into rice field and aquaculture pond ▪ Minimize disturbed areas
0+ 1440m	Traffic safety risk at the junction with the road (The new road will end at the intersection with Dong Hoi city bypass. There are no residents but two farms)  	▪ As per the design, this will be a big intersection between the project road and the city bypass to ensure safety during operation phase ▪ Minimize disturbance to the grass, landscaping the intersection with native plants. ▪ Place signboard to inform work in progress and speed limits and the entrance; ▪ clean up the road 50 m from each direction to prevent traffic safety risks.

5.2.18.3 Site- Specific Mitigation Measures for Sensitive Receptor

Table 5.5 below presents the site-specific mitigation measures to address the site-specific impacts on sensitive receptors.

Table 5.5: Site-Specific Mitigation for Sensitive receptor

No.	Sensitive receptor	Issues/Impacts	Specific mitigation measures
1	Dai Giac pagoda, 200 m from dredging area and Cong Muoi bridge (demolish the existing and build a new one) 	Disturbance to religious activitities, particularly on 1st and 15th lunar months Visual and aesthetic impacts Noise from bridge demolition and pile driving affect worhipping activities Disturbance to the monks and visitors	PMU will inform the pagoda managers at least one week in advance about construction schedule ▪ The camps and site office must be at least 100 m from the pagoda ▪ Environmental training for the workers includes codes of conducts when working in pubic areas and sensitive receptors such as pagodas ▪ Demolition and pile driving activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the monks ▪ No materials or wastes will be placed within 50 m from the boundary of the pagoda ▪ Fence the bridge construction side with 2.5 m solid fence to adequately block the view from the pagoda to the construction site. ▪ Clean up the disturbed areas daily, if it is within 100 m from the pagoda ▪ Construction plants and trucks will not be parked within 100 m from the boundary of the pagoda ▪ Halt construction activities if there are complaints from the pagoda, discuss and carry out corrective measures are implemented satisfactorily to the complainer. The case must be documented ▪ Avoid or minimise constrution activities during 1-15th lunar January, 1 and 15 th lunar months
2	Tam Toa Parish (is located near Thong Nhat road which is the transport route of dredged materials and waste to Cau Cup landfill) 	Transport trucks will increase traffic risks to travelers along this road; dust, emissions, and noise generated by transport trucks will affect religious activities of the parishioners at weekends, and cause impacts on	▪ Inform the Parish of the construction schedule and the potential impacts on the Parish such as waste, dust, and noise, traffic disturbance, at least 01 month before start of the construction. ▪ Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. ▪ Trucks must be slown down to 20 km when passing the Parish at the weekend ▪ Environmental training for the workers includes codes of conducts when working in pubic areas and sensitive receptors such as pagodas ▪ No materials or wastes will be placed within 50 m from the boundary of the Parish gate ▪ Construction plants and trucks will not be parked within 100 m from the

		the overall landscape of the road as well the view of Tam Toa Parish Parishioners worship on Sunday morning and during religious festivals	boundary of the Parish on Sunday morning and during their festival days ▪ Revise construction schedule and method if reasonalbe request is made from the Parish ▪ Avoid or minimise constrution activities during christmas time and day time on sundays ▪ Halt construction activities if there are complaints from the Parish, discuss, investigate the nature of the complaints and carry out corrective measures are implemented satisfactorily to the complainer. The case must be documented;
3	Phu Hai Ward Cemetery (Related to the component 2 contruction) 	The grass cover in front of the cemetary is disturbed. Access to the cemetery may be obstructed.	▪ Separate the construction/camp areas with solid fences. ▪ Maintain access to the gate of the cemetery. ▪ Do not park construction plants or load. materials, wastes within 10 m from the gate ▪ Avoid damages caused to the trees, reinstate vegetation cover . ▪ Limit construction work on 1st and 15th lunar month. ▪ Wastewater from camp will be led though closed pipes to irrigation canal. ▪ SEMP and workers codes of conducts strictly applied. ▪ minimise disturbed areas, big clean up the site a day before 1-15th lunar January, 1 and 15 th lunar months, and one week before 27th July
4	The Schools (Related to the construction school sanitation blocks and Pipeline installations)  	▪ Noise and dust ▪ Safety of students and teachers ▪ Traffic disturbance and increased traffic safety risks	▪ Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. ▪ If possible, implement the construction activities during the school summer vacation. ▪ Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering. ▪ Teachers to be informed of construction operations to keep pupils off the site during their break time. ▪ Prohibit use of construction methods that cause noise during school learning hours. ▪ Prohibit gathering of construction materials in front of the school.

			▪ Sprey sufficient water to suppress dust during dry and windy days at least three times a day at site. ▪ Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. ▪ Prohibit construction of workers camps within 2 km from the school. ▪ Sett up construction and traffic warning signs at the construction site. ▪ Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations, especially when school children go to and leave the school around construction area. ▪ Tidy construction materials and stockpiles every working session. ▪ Cover the incomplete trenches under construction at day's end. ▪ Providing night lighting system with luminously painted fence and night lamp. ▪ Immediately addess any issue/problem caused by the construction activities and raised by the school management.

5.2.18. Mitigation Measures for Cumulative Impacts

As the same PMU will also manage the ADB-funded project, thus the works of the two projects will be coordinated to mitigate the potential impacts.

The CCESP has been put into operation and all cumulative impacts for the CCESP are positive.

During construction of the Urban Environment and Infrastructure Development for Climate Resilience Project, Dong Hoi City, Quang Binh province (the ADB-funded project), full and proper implementation of environmental mitigation measures as specified in the EIA report will help to limit cumulative impacts of the CCSEP.

During the operation phase of the project, the treatment capacity of the WWTP will increase to 14,800m^3, resulting in more impacts on the surface water quality and the ecology of Le Ky river. To avoid these impacts, the mitigation measures presented in Section 5.3.1 must be implemented adequately.

5.3. MITIGATION MEASURES FOR OPERATION PHASE

5.3.1. Duc Ninh WWTP and Sewer System

According to the feasibility study of the project, the WWTP is built at capacity 10,000 cmd by 2014, 14,000 cmd by 2020 and 19,000 cmd by 2030. The treatment units and mitigation measures during operation phase of the WWTP has been designed to meet the designed capacity, only the sewer collection system need to be expanded. The provision of additional equipment and expansion of the sewer pipeline systems would bring the capacity of the WWTP from 6,200 cmd to 14,800 cmd. The WWTP has been put into operation since mid 2014 and the mitigation measures and monitoring procedures have been well set-up.

(1) Measures to minimize impact on receiving water

- Since combined sewers will be used, minimize bypass of the treatment system by providing capacity sufficient to treat peak flows;
- An online monitoring system is to be installed at the WWTP for controlling the wastewater inflow, quality of the influent and effluent at the WWTP;
- The quality of sample effluent from the WWTP must be analyzed once every 3 months;
- Treatment facilities are to be periodically checked and maintained to ensure highest performance of the system;
- Troubleshooting plans must be prepared to respond promptly to incidents in due time (standby generators, standby pumps, discharge incident)in order not to disrupt the operation of the plant;
- Based on an assessment of risks to human health and the environment, consider re-use of treated effluent, especially in areas with limited raw water supplies. Treated wastewater quality for land application or other uses should be consistent with the relevant public health-based guidance from the World Health Organization (WHO)[14] and applicable national requirements.

(2) Odor control

The following measures are required to prevent, minimize, and control air emissions and odors during operation:

- Domestic waste and sludge generated during the operation of the plant will be safely stored in a closed area before being transported away by URENCO to serve the planting of urban green trees or to be dumped at Luong Hoa landfill of the city. This will reduce bad odors generated from sludge;
- Cover emission points (e.g., aeration basins, clarifiers, sludge thickeners, tanks, and channels), and vent emissions to control systems (e.g., compost beds, biofilters, chemical scrubbers, etc.) as needed to reduce odors and otherwise meet applicable national requirements and internationally accepted guidelines;
- The waste (sludge and domestic solid waste) will be contained in standardized containers to minimize dispersion and gases and solid waste into the environment;
- There will be plans to periodically test and monitor air concentrations to obtain proper evaluation and control operation processes in a logical manner.

(3) Sludge

- Land application or other beneficial re-use of the WWTP residuals should be considered but only based on an assessment of risks to human health and the environment. Quality of residuals for land application should be consistent with the relevant public health-based guidance from the World Health Organization (WHO)[15] and applicable national requirements;
- Processing, disposal and re-use of wastewater treatment plant residuals should be consistent with applicable national requirements;
- URENCO will be employed to periodically dredge sludge from sewer systems and transport this sludge for disposal at Ly Trach landfill. Transportation will be carried

[14] WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater (2006).
[15] WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater (2006).

out by specialized tank trucks to avoid odor emission and sludge spillage along the route.

(4) Domestic Wastewater

Domestic wastewater from the WWTP will be pretreated through 3 compartments of septic tanks before being discharged into combined sewers and will be directed to the treatment area.

(5) Hazardous Waste

- The subproject owner will register as the owner of hazardous waste according to Circular No. 36/2015/TT-BTNMT dated 30 June 2015 on hazardous waste management;
- Containers of hazardous waste are to be placed on flat floors without tilting, tumbling, and must be free from stormwater infiltration. Collected hazardous waste will be stored in containers/houses and labeled as currently stipulated. Packaging materials for chemicals will be returned to the suppliers;
- Once every 2-3 months, the WWTP will have to employ a local contractor tasked with handing hazardous waste to collect, transport and handle such waste;
- Empty chlorine containers are to be returned to manufacturers.

(6) Worker Health and Safety at the WWTP, Pump stations, and Sewer systems

Worker occupational health and safety impacts associated with the operational phase of the WWTP primarily include the following: i) Accidents and injuries; ii) Exposure to pathogens and vectors.

Accidents and Injuries:

Work at the WWTP is often physically demanding and may involve hazards such as open water, trenches, slippery walkways, working at heights, energized circuits, and heavy equipment. Work at the WWTP may also involve entry into confined spaces, including manholes, sewers, pipelines, storage tanks, wet wells, digesters, and pump stations. Methane generated from anaerobic biodegradation of sewage can lead to fires and explosions.

The following procedures required to prevent, minimize, and control accidents and injuries at water and sanitation facilities:

The following procedures are required to prevent, minimize, and control chemical exposure at the WWTP:

- Install railing around all process tanks and pits;
- Implement a confined spaces entry program that is consistent with applicable national requirements and standards. Valves to process tanks should be locked to prevent accidental flooding during maintenance;
- Use fall protection equipment when working at heights;
- Maintain work areas to minimize slipping and tripping hazards;
- Implement fire and explosion prevention measures in accordance with the national regulation;
- Ventilate enclosed processing areas and ventilate equipment, such as pump stations, prior to maintenance;
- When installing or repairing the sewers and stormwater drainage sewers adjacent to roadways, implement procedures and traffic controls, such as:
    - Establishment of work zones so as to separate workers from traffic and from equipment as much as possible;

  - Reduction of allowed vehicle speeds in work zones;
  - Use of high-visibility safety apparel for workers in the vicinity of traffic;
  - For night work, provision of proper illumination for the work space, while controlling glare so as not to blind workers and passing motorists.
- Locate all underground utilities before digging.

Pathogens and Vectors:

The measures to prevent, minimize, and control exposure to pathogens and vectors include:

- Include in safety training program for workers, safe handling and personal hygiene practices to minimize exposure to pathogens and vectors;
- Use vacuum trucks or tugs for removal of fecal sludge instead of manual methods;
- Provide and require use of suitable personal protective clothing and equipment to prevent contact with wastewater (e.g., rubber gloves, aprons, boots, etc.). Especially provide prompt medical attention and cover any skin trauma such as cuts and abrasions to prevent infection and use protective clothing and goggles to prevent contact with spray and splashes;
- Encourage workers at wastewater facilities to wash hands frequently;
- Provide worker immunization (e.g. for Hepatitis B and tetanus) and health monitoring, including regular physical examinations;
- Reduce aerosol formation and distribution, for example by:
  - Planting trees around the aeration basin to shield the area from wind and to capture the droplets and particles;
  - Using diffused aeration rather than mechanical aeration and using finer bubbles for aeration;
  - Reducing aeration rate, if possible;
  - Use of floating covers on the mixed liquor of the aeration basin;
  - Suppression of droplets just above the surface, (e.g. by installing a screen or mesh above the basin);
  - Collection of droplets (e.g. by sedimentation, scrubber, electrostatic precipitator, or fabric filter);
  - Disinfection of airborne particles (e.g., by using ultraviolet lights);
  - Use of submerged effluent collector (such as pipes with orifices) rather than weirs.
- Avoid handling screenings by hand to prevent needle stick injuries;
- Maintain good housekeeping in sewage processing and storage areas;
- Advise individuals with asthma, diabetes, or suppressed immune systems not to work at wastewater treatment facilities, especially composting facilities, facility because of their greater risk of infection.

Land Application:

- Consider use of drip irrigation of treated wastewater, which minimizes worker exposure and the amount of water needed. Avoid use of spray irrigation of treated wastewater, if possible;
- Provide field workers with personal protective equipment, such as rubber gloves and waterproof shoes;
- Provide access to safe drinking water and sanitation (including hand washing) facilities;

- Provide worker health monitoring, including regular physical examinations;
- Control vectors and intermediate hosts.

(7) Leaks and Overflows

Leaks and overflows from the sewerage system can cause contamination of soil, groundwater, and surface water. Overflows occur when the collection system cannot manage the volume of wastewater, for example due to high flows during rain events or as the result of power loss, equipment malfunctions, or blockages.

Recommended measures to prevent, minimize, and control leaks and overflows include:

- Consider the installation of separate sewer systems for domestic wastewater and storm water runoff in the overall planning and design of new sewerage systems;
- When on-site sanitation systems where excreta are mixed with water predominate, consider use of small-diameter sewerage system to collect water effluent from septic systems or interceptor tanks;
- Limit the sewer depth where possible (e.g., by avoiding routes under streets with heavy traffic). For shallower sewers, small inspection chambers can be used in lieu of manholes;
- Use appropriate locally available materials for sewer construction. Spun concrete pipes can be appropriate in some circumstances but can suffer corrosion from hydrogen sulfide if there are blockages and/or insufficient slope;
- Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation;
- Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replace if broken to minimize entry of garbage and silt into the system;
- Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas;
- Establish routine maintenance program, including:
    - Development of an inventory of system components, with information including age, construction materials, drainage areas served, elevations, etc;
    - Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. Cleaning activities may require removal of tree roots and other identified obstructions;
    - Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration;
    - Monitoring of sewer flow to identify potential inflows and outflows.
- Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);
- Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;

- When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

(8) Incidental Discharge from the WWTP:

The WWTP system includes the components of biological treatment tank, flocculation tank, biological aeration tank, and bio-filters which will be designed with the two modules running in parallel to remedy any incident when it happens, specifically:

- In case incidents due to breakage, damage, or leakage:

- Normally, a problem – if any - happens in only one module, the WWTP Company will operate the remaining module while repairing the malfunctioning one. If fixing the incident takes too much time, exceeding the storage time of work items in the system, the Company will suspend operation to solve the said incident problem.

- In case of incidents with wastewater plant (wastewater pumps, air blowers,):

- All the devices in the WWTP system are equipped with one backup device. Thus, if case of errors occurring with a device, the Company will make use of the standby device and have the faulty one repaired.

- In case of incidents caused by operation:

- When a problem occurs, the technical division and the operating worker will have to review all operational parameters and make adjustments in conformity with the design;

- In case of serious incidents, e.g. the system is unable to work and the treated wastewater fails to meet the standards of discharging treated water and pollutes the environment for a long time, the Company will report this incident to the management agency, i.e. Quang Binh Department of Natural Resources and Environment, and suspend production to fix the problem. The Company will employ an expert on wastewater treatment to make inspection and adjustments to the system;

- Corrective measures are to be promptly carried out for the treatment plant to be operated again in the soonest possible time.

Standby generators must be always available.

5.3.2. Solid Waste Collection System

As discussed in Section 2.4.5, the solid waste collection system in Dong Hoi has been running quite well. The Ly Trach landfill has been improved under CCESP. With the additional equipment provided, URENCO has been and will be continued in compliance with the Standard of Operation (SOP)/ Operation Manual (OM) for operation of the landfill as discussed in Section 2.4.5.

5.3.3. School and Public Toilets

Before taking over the school toilets, the schools shall be required to commit to maintain the facilities as per the O&M manual.

The public toilets will be handed over to the Beach Management Unit that shall make commitments on keeping the toilets clean and safe for local people, including the disable, controlling odor release, no negative impacts on urban aesthetic view, and operating and maintaining as per the O&M manual.

- Arranging workers to regularly clean school toilets;

- The schools provide training and awareness raising campaign in school clean water and sanitation for the school children including using hygienic drinking water, washing hand with soap, and school and environmental sanitation.

5.3.4. Mitigation Measures for Operation Phase Impacts of Component 2

The measures for mitigating these operation impacts have been or will be incorporated into the design (junction, slope protection, drainage, lighting and landscaping etc.). Road management authority should maintain traffic sign system and road surface conditions to maintain road safety and limit emissions from transportation means.

CHAPTER 6. SOCIAL AND ENVIRONMENTAL MANAGEMENT PROGRAM

6.1. BASIC PRINCIPLE

As a part of the ESIA, an Environmental and Social Management Plan (ESMP) is a safeguard instrument that is typically used in many projects and consists of information and guidance for the process of mitigating and managing adverse environmental impacts throughout project implementation. Key contents of the ESMP include: i) summary of key potential social and environmental impacts and risks; ii) mitigation measures to be implemented during pre-construction, construction and operation phases; iii) an environmental monitoring and supervision plan; iv) institutional arrangements, capacity building and training; v) cost estimation; and vi) a grievance redress mechanism.

6.2. SUMMARY OF KEY POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND RISKS

The Project will acquire 141.655,2m2 of agricultural land, water surfaces, and public land, affecting 85 households with 454 people. No households will be relocated. There is a risk of UXO that is left at the construction sites as a war result.

During the construction phase, the potential negative impacts that are predicted and assessed include:

6.2.1. Common construction impacts

1. Air Pollution

- Dust generated from transportation, loading and unloading, temporary gathering of construction materials such as soil, sand, stones, cement and wastes, or generated during construction, especially earthworks;
- Gas emission from cars, trucks and construction plants such as excavators and cranes;
- Odor generated from sludge and sediment dredged up from existing sewers and Cau Rao river;
- Noise from construction plants, rock dumping operation and during bridge construction.;
- Vibration generated by piling activities during bridge construction.

2. Generation of Wastewater and Stormwater

- Stormwater runoff through construction areas entails mud and soil;
- Wastewater generated during washing of vehicles and construction plants. The amount of generated wastewater is 1.08 m3 per day (32.4 m3 per month).

3. Generation of Solid Waste

- Solid wastes are generated during excavation and dredging at Cau Rao of which the dredged sediment has a salinity is 10% and demolishing of the existing Cong Muoi bridge. The total waste materials of 151,796 m3 (229,150 tons) will be disposed off at Cau Cup landfill;
- Top soil removed from rice fields along the alignments;
- Operational activities of the workers generate 21 kg per day (11.1 tons per 24 months)
- Wastes generated during construction: card boards, wood scraps, packaging, construction materials, mortar wastes, etc;
- Hazardous waste: from sanitary maintenance activities of construction equipment, transportation.

4. Water Quality Reduction

- Dredging and embankment lining at Cau Rao River and construction of Cong Muoi bridge;
- Surface runoff from the construction sites to Le Ky river and irrigation canals;
- Wastewater generated by the workers' activities;

- Wastewater generated during washing of vehicles and construction plants.

These contamination sources affect the surface water and increase turbidity, oil and grease levels.

5. Biological Impacts

- Clearing and removing weathered soil layers to create space: direct impacts on terrestrial organisms (plants, vegetation, terrestrial fauna habitat loss, etc.);
- Dredging and bridge construction at Cau Rao River: direct impacts on aquatic systems of Cau Rao River;

- Dumping waste materials at Cau Cup landfill: direct impacts on the surrounding ecosystem (trees, terrestrial animals);

- Cut down 460 trees (eucalyptus, bamboo, acacia, casuarina, melaleuca), disturb 200m2 of grass cover in front of Phu Hai Ward Cemetery;

- 2.6 ha of agricultural land and 5.2 ha of aquaculture ponds will be acquired for road construction. There is a risk of mimosa pigra, an invasive plant, spreading into the construction area and affecting the remaining agriculture land;

- Aquatic species within an area of 200-300 m2 around the construction area of bridge abutments and piers will be affected.

6. **Impacts on Landscape**

Earthworks, and construction of drains, manholes, pumping stations, and toilets will impose direct impacts on the urban landscape at construction sites and on tourist activities along Nhat Le coastline, schools, hospitals, offices, etc. Meanwhile, material collection and temporal disposal sites will affect local landscapes. Material transportation and waste disposal will affect the landscapes along the transport routes.

7. **Flooding and Sedimentation Risks**

Earthworks and construction of drains and pipes can increase flooding, partial sedimentation at the construction sites when heavy rains occur, as well as sand falling and sedimentation. Meanwhile, Cau Rao River dredging can change the flows (being blocked or divided), resulting in drainage issues during the rainy season, then flooding might occur.

8. **Subsidence and Landslide Risks**

Digging deep holes (for construction of sewers, pumping stations, toilet works, bridges) can cause landslide.

9. **Traffic Disturbance and Increased Traffic Safety Risks**

Traffic will be obstructed by earthworks during drain construction and temporal material storages. Traffic routes in the project areas will be disturbed with more safety risks by material transportation and waste disposal, especially at the intersections at the two alignment ends. Cong Muoi bridge construction will disrupt traffic on Le Loi road;

10. Impacts on Infrastructure

- The existing sewers, power supply systems, water supply pipelines, drains, and underground works along 23 km of roads within construction areas of drains and pumping stations will be affected;
- Dredging and embankment lining at Cau Rao River might affect seven stormwater drains
- Trees on the sidewalks (shade trees, 4-6 m tall, no big trees) can be affected when hoisting bulky materials;
- Digging 4-6m deep may crack surrounding houses and structures.

11. **Social Impacts**

Sewers construction may disrupt daily life and business activities of households, administrative agencies, and tourists' activities around the construction areas. Whereas, concentration of workers in areas may cause social disorder and increase social diseases.

12. **Community Safety and Health**

All activities in the construction phase can affect health of the workers and local people around the construction areas.

13. **Workers' Safety and Occupational Health**

Construction workers often face safety risks while constructing bridges at 5-6 m height and pumping station chambers at 6-9m depth, working outdoor during hot days, or not being provided with adequate safety clothing, etc.

6.2.2. Site–Specific Impacts

Construction phase

1.Dredging and Embankment Lining of Cau Rao River, and Construction of Cong Muoi Bridge:

Generation of 13,214 m^3 of dredged sediments with salinity at 10°/oo. Land is needed for temporary and final disposal; Construction of Cong Muoi Bridge during 12 months will interrupt the traffic on Le Loi Road at Cong Muoi Bridge section.

2. Pumping Stations*:* Safety risks for the workers when disturbing bushes at the sites (insects, broken glass, needles, etc.), traffic safety risks, community safety risks;

3. Construction of drains and sewers: Impacts on traffic, business and tourism activities, and daily activities of the local people along the construction routes such as Ly Thai To, Le Hong Phong, Phan Dinh Phung, Le Loi, Truong Phap, and Hoang Sam.

4. Construction of Le Ky and Cau Ray bridges and the road: Impacts on agriculture production and the existing irrigation canal at the construction sites.

Operation phase

1. The WWTP Operation Phase: The treated effluent of 14,800 m^3 per day discharged into Le Ky river might cause impacts on the surface water quality and the ecology of Le Ky river in case of operation incidents, for example, the Plant stops treatment or the treated wastewater do not meet requirements of Column B1-QCVN 08:2015/BTNMT, etc. The sludge of 289 tons generated per year which is dredged once every one or two years will create insanitary conditions of the area if not being treated properly. Odor generated during the WWTP operation will affect the quality of ambient air.

2. School and Public Toilets: it is difficult to keep public and school toilets clean from accumulated dirt, bad smell, harmful bacteria and viruses that affect the users' health.

6.2.3.Impacts on Cultural, Historical, and Religious Works

Cultural and religious institutions that are potentially affected during the operation phase are as follows:

- Dai Giac pagoda locates 200 m far from the dredging site and 450 m far from the Cong Muoi bridge. Local people often visit the pagoda on the first and the full moon days or the Lunar New Year. Dredging activities and embankment lining of 475 m of Cau Rao River, and demolition of the existing Cong Muoi Bridge as well as construction of the new bridge will release dust, and temporary storage yards of construction materials and dredged sediments and construction wastes will affect the pagoda landscape. Noise may negatively affect religious ceremonies; transport of materials will cause traffic risks to the

people visiting the pagoda; and mobilization of a large workforce may impose security risks;

- Tam Toa Parish where local parishioners worship at weekends and during religious festivals locates near Thong Nhat road which is the transport route of dredged materials and wastes to Cau Cup landfill;
- Dust will be released from construction materials stored in front of Phu Hai Ward Cemetery in south-easterly wind which is the main wind, affecting landscape of the cemetery.

6.3. MITIGATION MEASURES

The mitigation measures to be implemented during pre-construction, construction and operation phases are summarized in Sections 6.3.1 and 6.3.5. Type-specific and site-specific management plans are also included in Sections 6.3.3 and 6.3.4.

6.3.1 Pre-Construction Phase

The PMU and the Resettlement Committee of Dong Hoi City will arrange compensation and support for the affected households in accordance with the guidance and procedures specified in the RAP as summarized in Tables 6.1 below:

Table 6.1: Entitlements for Affected Households (AHH) and Persons (AP)

Type of Impacts	Entitlement by Category
Agricultural land acquisition	**3. HHs affected with < 20% of production land area or < 10% for vulnerable group** For those who have the right to legally use or can legalize the land use right, the project will compensate "land for land" or compensation in cash for the land and assets on the land at 100% replacement cost.[16]. If the area of the remaining land after acquisition is not enough to continue cultivation, the project will acquire the entire piece of land and compensate by "land to land" or in cash. Affected households are also supported with livelihood recovery assistance such as cash, vocational training and job creation: For the people who use temporary land or leased public land of wards/ commune, compensation shall be provided for investments made on the land. These PAPs will also receive additional support for income rehabilitation if they are directly involved in agricultural activities. For other cases, affected people who lease land shall be compensated for cost of investment in remaining land and assets they create on the land with 100% replacement cost. For those do not have legal land use rights and if *the* land used before July 1, 2004, land users will be compensated for 100% replacement cost. For other cases, affected people will receive assistance equivalent to the value of remaining investment on the land. Households affected by loss of less than 20% of land, where the remaining land is rendered unviable for continued use, will be assisted with the above support plus any additional support as determined, for a period of 12 months.

[16] When regulations of the State and the province don't meet standards of compensation at replacement cost, compensation under domestic law is supplemented by necessary assistance measures to meet the replacement cost standard.

	4. **HH seriously affected (loss of ≥20% production land or ≥10% with vulnerable groups)** Afffected HHs who have right to legally use or can legalize land use rights will receive compensation and assistance and allowance. Support for life stabilization is in cash equivalent to 30 kg of rice / person / month and: (iv) PAPs losing 20 - 70% of their agricultural landholding (or 10 - 70% for the poor and vulnerable groups) will be compensated with 6 months income from that land; PAPs losing more than 70% of their agricultural landholding will be assisted with 12 months income from the land or at the provincial policy, whichever is higher; (v) Poor households who lose ≥ 20% of production land, or lose less than 20% but the remaining land for cultivation is not enough will be supported by cash equivalent 30kg rice /person/ month for 24 months. Other poor households is supported by cash equivalent 30kg rice / person / month for 6 months or at the provincial policy, whichever is higher. (vi) Other vulnerable groups: female headed households with dependents, households with disabled people, elderly without support and families of ethnic minorities will get allowance at the provincial policy or the money allowance equivalent to 30 kg of rice / person / month for 6 months, whichever is higher. For people who use temporary land or leased public land of wards/ commune, or those do not have legal land use rights will also receive Compensation and assistance
HH affected with non-agricultural land and business	***Marginally affected (<20% land or <10% to vulnerable/poor HH*** HH or AP have Land use rights certificates (LURCs) or are eligible to have LURC will be compensated with "land for land" or cash at replacement cost. HH or AP who use leased land will be compensated equivalent to remaining values invested in such lands and assets on the land at 100% replacement cost. Allowance for production, business rehabilitation: (iii) Businesses / households with business registration will be compensated or supported. The maximum compensation/support is 30% of after-tax income of 01 years based on their average annual of the last three years which have been declared to the tax authorities; (iv) Households without business license but who have met their tax obligations will be entitled to compensation equivalent to 50% of support level for businesses/households with business registration.
Houses and structures	Owners of Partly affected houses/ structures built before the cut-off date will be compensated in cash for affected part of the project at 100% of the replacement costs. If the works affected partly, users will be paid an allowance of repair.
Crops and Trees, livestock	For annual and perennial standing crops, compensation will be paid to households who cultivate the land with full replacement cost. For plants, which have not been harvested yet but can be brought to another location, the transportation cost and the actual damage due to the transportation and re-planting must be compensated No compensation for livestock which could relocate or harvest but the transportation cost and the damage caused by the transportation will be compensated. Affected people will be compensated in cash at replacement cost at the time of land acquisition.

The total budget for land acquisition compensation and support is VND 71,862,554,265 (US$ 3,195,150 equivalent)

The PMU shall sign contract with a specialized army unit to carry out UXO clearance before handing over the sites to the contractors. The estimated costs for UXO clearance is VND 9,747,000,000 (US$ 443,045).

The engineering design consultant shall incorporate following environmental solutions and mitigation measures into engineering design and cost estimate. The to-be-applied measures to each type of investments are specified below:

Design of Drainage and Wastewater Collection System, and Pumping Stations

- Choose the alignments of the pipelines following existing roads, footpaths taking into account the city relevant plans in order to minimize land acquisition and smooth connectivity with future investments;
- Include structures for erosion protection surroundings and at the bottoms of the outfalls;
- Sewerage system would be designed based on surveys on local hydrological regime (such as flood level, flow regime etc.), topography and geology to ensure effectiveness;
- Sewerage systems would be proposed to be designed with box culverts, CSO and anti-odor manholes where coming across residential areas;
- Pump stations located at public places would be designed to ensure safety and landscape beauty, with fences and warning signs;
- Different alternatives concerning the alignment and scope of the work items have been considered, and priority is given to those alignments which are likely to exert fewer or negligible impacts such as crossing uncultivated land, agricultural land or public land with few residents, or those running along existing roads. At intersections with residential areas, different options have been considered, and necessary adjustments have been made so as to minimize the number of displaced people. The alternatives of reducing the designed width of roads or intersections have been introduced for analysis and consideration;
- Apply measures to ensure safety for pumping stations: cover and lock the pump chambers, closed and water-proof electrical panels, warning signs to ensure safety during operation phase of pumping stations, reinstatement of disturbed roads surface and footpaths included in engineering design and cost estimation. For the pump stations located at public places, designed will also be designed with landscaping, with fences and warning signs

Cau Rao River and Cong Muoi Bridge

- Design of the embankment ensuring continuity of landscape of the area by choosing appropriate design parameters (elevation, supplement facilities such as footpath, lighting and tree planting etc.) and materials used;
- Combine engineering with biological measures is applied for protecting the embankment from erosion;
- Design of riverside road includes trees planting and lighting.;
- Design of Cong Muoi suit the landscape for the city, fit in the urban landscape and provide smooth connection with Le Loi road. .

School and Public Toilets

School toilets:

- A roofed corridor connecting classrooms with toilets is provided to ensure safe access in rainy weather; pave the floor with non-slippery materials;
- Design of the building allows maximizing the use of natural lights for lighting and disinfection. Select environmental-friendly materials such as unburnt bricks, energy-saving electricity and water equipment;

- Ensure adequate ventilation for the toilets to mitigate odor during operation phase;
- The toilets include hand-washing sinks. Posters with messages related to handwashing and hygiene included in the design of the toilet building. Apply good landscape design to attract young students;
- The school toilets will be designed to ensure aesthetic beauty, friendliness and safety for the pupils, and for children with disabilities and include: i) separate toilets for girls and boys; ii) inside locks; iii) antisloppy floor; iv) enough light; v) separate toilets for children with disability which include safe wheel chair access and wall mounted grab rail.

Public toilets

- Design of toilet building is in harmony with the surrounding landscapes;
- The design includes access and room for wheelchairs.

Le Ky and Tay Bridges and Road

- Design the junctions at the two ends to ensure safety for traffic. The junction with National Highway 1A (NH1A) and Quang Trung Road include side access and traffic signs to allow the traffic flows joining and separating smoothly and safely;
- Detail design include access for farmers and local residents from existing agricultural land to the proposed road;
- Design compensatory irrigation canal and waterworks affected by road construction to ensure continuity of the canal's service;
- Compensate for the landscape and the tree cut off by planting trees along the road dividers and footpaths with trees and energy-saving lamps;
- Rehabilitate and improve the landscape for the area in front of the martyr's cemetery;
- Design the bridge with sufficient width and height clearance for waterway transport in the Le Ky river (small fishing boats);
- Zebra crossing is provided for walkers and road instruction signals are designed for the disable;
- Road design include drains to prevent flooding during operation phase;
- Surface water drainage system, street lighting system and traffic signs will be designed to meet relevant requirements. Traffic systems and intersections with existing streets are designed with proper width so visibility and traffic safety are ensured when the constructions are put into operation.

6.3.2. Mitigation Measures for Construction Phase

The mitigation measures for common negative impacts during the construction phase are presented in Tables 6.2 in the form of Environmental Codes of Practices (ECOP).

ECOP, together with relevant type-specific and site-specific mitigation measures will be included in the construction contract signed between the PMU and the Contractor. In addition, each contractor will be required to prepare Site-specific Environmental Management Plan (SEMP) to cover all measures that the contractor will carry out to address potential impacts and risks associated with the works that they are contracted to implement.

Table 6.2: Environmental Codes of Practices (ECOP)

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
Impacts on Air quality because of Dust, Exhaust, Noise, and Vibration	• Maintain emission level at construction sites below the allowable limits set in QCVN 05: 2013/BTNMT • Only use machines with emission levels meeting TCVN 6438-2005 and with valid registration; • Load and gather materials and waste neatly. Arrange workers to collect and gather construction materials and wastes to designated places at the end of each day or shift; • Where a construction site is near residential houses or public buildings, spray roads with water at least three times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25^{o}C, or in windy weather. Avoid over watering as this may make the surrounding muddy; • Cover trucks carrying wastes and bulky materials tightly before leaving construction sites; • Do not overload materials/ soil and stone as they will drop along transportation routes and cause dust and accidents. Trucks carrying wastes and bulky materials must be tightly covered; • Guard or cover loads of materials or waste loads with volume of 20m^3 or more to avoid dust dispersion; • Avoid preparation of construction materials, such as concrete mixing, near local peoples' houses or other sensitive structures such as pagodas, schools, medical stations or offices. Transport wastes out of construction sites to designated locations for reuse or to disposal sites as soon as possible; • Avoid temporary on-site loading of dredged materials from canals. If temporary loading is unavoidable, implement pollution control measures such as covering, putting in bags, or isolation. Inform communities in advance so they can be prepared for odour and nuisance problems; • Burning wastes at construction sites is prohibited, except burning invasive plants if found at sites; • Turn off vehicles and machines if parking longer than two minutes. Wash the vehicles used for transporting materials and construction wastes periodically at designated areas;	- QCVN 05: 2013/BTNMT -TCVN 6438-2005 -Decision. 35/2005/QD-BGTVT -QCVN 05:2013/BTNMT - QCVN 26:2010/BTNMT - QCVN 27:2010/BTNMT	- Investment owner - Contractors - Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	• Set up areas for vehicle washing at the exit/ entrance of centralised construction sites to prevent the dusts from trucks spreading onto streets. Apply speed limits at 40 km per hour or lower to trucks when running on inner-city roads or through residential areas. Acceleration and horn flaring are prohibited near sensitive areas such as hospitals, schools, sites of religious practice, etc. • Avoid to implement activities that likely generate loud noises and vibration from 6 pm. to 7 am. of the next day if the construction site is near residential areas or health care facilities. If construction at night time is unavoidable, inform communities at least two days in advance; • Place machines generating high level of noise as far as possible from residential areas so noise levels at the receptor areas can be maintained at below 70dBA, i.e. Avoid activities that generate loud noises during sensitive hours, or install mufflers onto devices to reduce noise. Inspect, maintain and clean construction plants periodically; • Schedule transportation plans how to avoid a large number of machines and equipment being at the same time and at the same site; • Apply successive construction method to construct routes with relative long alignments such as canals, secondary drains/ sewers, and tertiary sewers; • Install and maintain 2.5-metre high solid fences at construction sites with significant volume of earthworks or near sensitive receptors; • Where possible, get power supply from the existing grid instead of using generators to avoid loud noise generated by diesel generators; • Provide dust marks for the workers and enforce the use when working in dusty conditions.		
Generated Waste water	• Toilets must have septic tanks for wastewater treatment before being discharged into the environment; • Mobile toilets or septic-tank toilets should be provided for the workers at centralized construction sites; • Load construction materials in elevated sites to avoid flooding. Cover material piles; • Avoid temporary loading of excessive volume of construction materials at one time at construction sites;	- QCVN 14:2008/BTNMT - QCVN 08-MT:2015/BTNMT	- Investment owner - Contractors - Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	• Store excavated materials only at designated areas approved by the Construction Supervisor. Protect such storages to avoid direct contact with surface runoff; • Minimize quantity of fuel stored at sites. Fuel storage area must be at least 20 m far from any water sources, roofed, fenced, on provided with impermeable and bound ground to control spill; • Do not maintain vehicles or replace oil at sites. Collect and store wasted oil in plastic containers with lid; Place these containers on impermeable and bound surface for spill control; • Locate workers' camps at least 10m far from any surface water bodies; • Provide adequate sanitation facilities and bathrooms with proper drains for the workers. Wastewater must be collected and treated before being discharged into the environment. Ditches must be cleaned up periodically; • Create sedimentation traps and maintain them periodically to ensure that most solids in surface runoff are retained in the traps before entering the existing drains or water sources surrounding the sites; • Inspect, dredge, and clear the drains at sites and the surrounding areas periodically to prevent sedimentation and blocking; • Wastewater from designated truck washing areas, equipment washing areas, etc., if any, must be collected and treated before being discharged into the environment; • At completion of construction works, refill and seal safely the drains, ditch etc. soak pits and septic tanks, dismantle contractor's site office and any areas disturbed during construction, reinstate the disturbed areas d before handing over the site. Remove and transport to acceptable disposal site the soil contaminated with oil, if any; • Set up toilets in the camp areas and large construction sites for the workers to use. There are separately toilets for male and female workers, one toilet room for every 25 workers. When construction is over, these toilets will be refilled and sealed safely; • Domestic wastewater generated at workers' camps must be collected and treated before being discharged into the environment.		
Generated Solid Waste	**Non-hazardous Waste Management**	Decree 59/2007/NĐ-CP	- Investment owner - Contractors

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	• Solid wastes will be managed in accordance with Decree No. 59/2007/ND-CP dated 09 April 2007 on solid waste management and Decree No. 38/2015/ND-CP dated 24 April 2015 on management of waste and waste materials; • Minimize garbage generation; • Carry out waste separation at source; • Promote reuse and recycling. Materials such as glass, wooden plates, steel, plastic, scaffolding materials, site holding, packaging materials, etc. shall be collected and separated for reuse for other projects or sold for recycling; • Provide garbage bins at construction sites, site offices and camps; the bins shall be covered with lids, weather-proof and scavenger proof to avoid dispersion of bad odors, leachate leakage, attracting flies, mice and other vermince; • Collect wastes and tidy up construction sites at the end of each working day/ shift. Transport wastes out of the construction sites as soon as possible; • Collect all wastes and residual materials and transport them to the disposal sites by Quang Binh URENCO (the certified contractor) or for use later; • Cau Rao River as stipulated in the specific mitigation measures. **Hazardous Waste Management** • All hazardous waste (waste oil, grease, organic solvents, chemicals, oil paints, etc.) must be temporarily stored, handled, and transported and disposed off in accordance with Circular No. 36/2015/TT-BTNMT dated 30 June 2015 by the Ministry of Natural Resources and Environment on hazardous waste management; • Hazardous waste shall be transported out of sites in cooperation with an approved and authorized partner; • Collect and store used oil and grease separately in specialized containers. Place these containers in safe and fire-free areas with impermeable floors, roofs, at safe distances from fire sources; • Return unused or rejected tar or bituminous products to the suppliers or manufacturers.	Decree 36/2015/TT-BTNMT	- Supervision Consultant
Reduced Water quality	• The Contractors are responsible for controlling surface water quality when discharging it out of construction sites, in accordance with QCVN 08-MT:2015/BTNMT and QCVN 14:2008/BTNMT;	QCVN 14:2008/BTNMT QCVN 08-MT:2015/BTNMT	- Investment owner - Contractors - Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	• Store used and unused oil and petrol on impermeable grounds covered with roofs, with warning (flammable and danger) signs, and contained within surrounding fences for easy control and collection in case of leakage. Locate oil and petrol storage areas at least 25m from any ponds, lakes, rivers, and streams. Restrict accessibility to these temporary storages to only authorized persons; • Perform concrete mixing on impermeable ground only, at least 20m far from any water sources. Collect wastes and wastewater containing cement at sedimentation traps and drainage ditches regularly to limit number of solids entering receptors; • Maintain vehicles and replace oil at designated workshops only. Do not perform these activities at sites; • Collect and keep used/ waste oil and materials polluted with oil/ chemicals in containers, store in safe places (on impermeable grounds, roofed, fenced and with warning signs) for regular collection by licensed dealers; • Carry out concrete mixing on impermeable grounds only. Collect wastes and wastewater containing cement at the sedimentation traps and drainage ditches regularly to limit number of solids entering receptors; • Provide sedimentation pits and ditches at big construction sites; • Provide appropriate toilets for the workers; • Avoid carrying out excavation and backfilling in rainy weather; • Collect and transport materials and wastes generated during excavation and backfilling materials to designated sites for reuse or final disposal as soon as possible; • Temporary loading of construction materials or concrete mixing are allowed only at places where at least 50m far from any ponds, lakes, rivers, streams, or other water sources, or at maximum possible distances between temporary loading locations and canals; • Collect and transport excavated soil out of construction sites within 24 hours. Dredged materials must be transported away from temporary disposal sites as soon as they are dry sufficiently; • Maintain vehicles and equipment, including oil replacement or lubrication, at designated areas only. Ensure that no chemicals, petrol, oil, or grease are leaked into the soil, drains or water sources. Use trays to hold rags and materials used in		

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	maintenance. Collect and dispose off wastes in accordance with hazardous waste management requirements.		
Flooding Risks	• Check the existing drains within and surrounding the construction sites, improve them before levelling to ensure that rainwater can be drained properly; • Load construction materials and wastes at least 10 m far from any existing drainage ditches or water sources to minimize materials from entering the channels which may lead to sedimentation and blockage; • Clean up the existing drains regularly.		- Investment owner - Contractors - Supervision Consultant
Erosion and Sedimentation	• Strictly monitor excavation and backfilling operation, especially in the rainy season. Minimize disturbance to existing vegetation and trees. Reestablish vegetation covers in disturbed areas as soon as possible; • Transport wastes out of the sites within the shortest time possible but should not later than two days; • Install and maintain sedimentation traps within and/ or surrounding centralized construction sites. Remove soil, stones and wastes periodically from traps to maintain their functions; • Gather materials and wastes neatly to limit the amount of materials being swept away by rainwater; • Carry out leveling and rolling after waste disposal at the disposal sites to minimize erosion; • Use Larsen sheet piles to protect walls/ slopes when excavation is deeper than 2.5m. Reinforcing piles must be checked and maintained to ensure stability of excavated trenches and holes; • Level the disturbed areas to prevent erosion; • Strictly avoid disturbance or damages to the existing vegetation and trees.		
Traffic Disturbance and Safety Risks	• Install and maintain sign boards, fences, signal lights to direct traffic to ensure traffic safety. Ensure adequate lighting at nighttime; • Before transportation, trucks must be covered very carefully, materials must not be loaded to 10cm higher than the truck body so that materials are not dropped or scattered onto roads, causing dust and accident risks;	Traffic Safety Law 23/2008/QH12 Construction Law 50/2014/QH13 – Circular 22/2010/TT-BDX	- Investment owner - Contractors - Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	• Place speed limit signs at 100m from construction sites. Place additional signs if construction site is within 20 m from the gates of any schools, markets, hospitals, pagodas, densely populated areas, narrow roads, etc., arrange worker to guide traffic in rush hours; • Coordinate with the police for traffic diversion as necessary; • Collect and tidy up wastes and wastewater containing cement at the sedimentation traps, ditches regularly to limit the number of solids entering receptors; • Avoid loading and unloading materials during rush hours; • Only use vehicles with valid registration. Trucks must be covered to prevent materials from dropping along the routes that cause dusts and accidents; • Do not park construction vehicles on the roads longer than needed. Vehicles should be parked only for loading and unloading of materials and wastes; • Provide additional hard sheets crossing open trenches/holes passing houses/shops as and when needed; • Arrange staff/workers to assist young children and aged people crossing temporary access if possible; • Ensure temporary access for wheelchairs to affected households having disabled people if required; • Plan and implement construction activities at nighttime at locations where traffic is too busy in order to reduce traffic disturbance and traffic safety risks • Install night lighting at all construction sites.		
Impacts on Existing Infrastructure and Services	• Only use vehicles with sizes and loads within permissible limits set for the roads along such vehicles' routes; • Inform the affected households at least two days in advance when water or power is cut off for construction; • The Contractors shall be responsible for repairing and restoring all damages of the road and bridge due to overload transportation;		- Investment owner - Contractors - Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	• Arrange workers to observe crane drivers when operating with bulky items such as large pipes or cranes in order to avoid damages to electric lines or any other nearby existing infrastructure; • Reinstate all disturbed or damages infrastructure, including road surfaces and footpaths; • The Contractors will be responsible for repairing, recovering, and compensating at their own costs for all damages caused to existing infrastructure at the contractors' faults; • Reinstate the road surfaces and sidewalks disturbed by construction after construction has been completed.		
Impacts on Organism, Aquatic system	• Minimize disturbance caused by construction activities, especially at areas having green trees or vegetation. Do not use chemical substances to clear vegetation; • Do not pile up materials and wastes at vegetation covered areas. • Embank construction areas to limit impacts on water sources • Do not destroy vegetation and green trees outside construction areas • If possible, transplant green trees to other places before constructing pipelines on pavements	Environment Protection Law 55/2014/QH13	- Investment owner - Contractors - Supervision Consultant
Impacts on Urban Landscapes,	• Place the signboard "Sorry to disturb" at the construction sites located in popular areas; • Keep the disturbed areas to be minimal; re-establish vegetation covers as soon as construction is completed; • All facilities are maintained in neat and tidy conditions and the sites shall be kept free of litter; • Fence the construction sites with solid materials if the construction sites are exposed to sensitive sites or exposed to tourist areas; • Do not load construction materials or wastes within 10 m from the gates of any public buildings or cultural structures such as government offices, temples, schools, etc.; • Collect and transport excavated materials and construction wastes to the disposal sites within 24 hours; • Clean up the construction sites daily if the sites are located in populated areas; • Wash vehicles periodically to prevent dust dispersion onto roads.		- Investment owner - Contractors - Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
Impacts on Cultural Heritages	• When construction activities are carried out near any cultural and historical sites such as pagodas, churches, temples, the Contractors shall schedule construction to avoid festivals or special events that may take place such as full moon days and public holidays. When carrying out the works in such areas, the Contractors shall implement good site management practice, including cleaning up of the sites regularly, loading materials in a tidy manner, and transport wastes out of the sites as soon as possible. • If the cultural sites and/ or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the Project's Owner will need to make necessary design changes to accommodate the request and preserve the site; • Decisions concerning management of the findings shall be communicated in writing by relevant authorities.	- Law on Cultural Heritage No. 32/2009/QH12 - Decree 98/2010/ND-CP	- Investment owner - Contractors - Supervision Consultant
Social Impacts	• Contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on safety in construction; • The contractor shall register the list of workers with the local authorities for temporary residence; • The contractor shall inform the community about construction plan at least 2 weeks before commencement of the construction; • In case electricity and water supplies are to be disrupted, the PMU must inform PAHs at least 2 days in advance; • Avoid construction operations at night time. Where construction at nighttime is inevitable the community must be informed at least 2 days in advance ; • Rolling/stagged construction methods shall be applied to pipeline installation packages. Construction should be performed within the shortest possible time, particularly at sections passing populated residential or business areas; • Construction sites shall be kept tidy and safe; • Wooden planks with adequate strength and width must be placed over the open ditches to provide temporary access to roadside houses and shops; • Do not park construction vehicles on the roads in populated areas longer than needed. Vehicles should be parked only for loading/unloading materials and wastes; Keep	No. 22/2010/TT-BXD	- Investment owner - Contractors - Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	duration of temporary storage of materials and wastes at the site to be minimal. Refill the pipetrench /open holes soonest possible. • If visions to shops/businesses are blocked by construction activities, instruction signs observable from the main road will be provided. • Provide additional hard sheets crossing open trenches/holes, arrange staff/workers to assit local people taking their motorbikes/goods in and out of the houses/shops as and when needed; • Ensure temporary access for wheelchairs to affected households having disabled people if required • Allowances are provided for 200 affected business households along the road. The allowance amount is VND 30,000,000 per household as per Decision 22/2014/QD-UBND Quang Binh, equivalent to 30% of one-year, tax-excluded average income; • Hire local laborers to carry out simple tasks; • Provide training to workers on the Codes of conducts and modes of communication with local communities which cover, but not limited to the followings: • + Use adequate safety gear provided; • + Smoke at designated places only. Do not litter construction sites; • + Storing or use of weapons and toxic substances is prohibited; • + Do not cut trees outside construction sites or set fire to waste on-site(except invasive plants); • + Drinking of alcohol during working hours is prohibited; • + Do not operate construction plant if not authorised to do so; • + Do not engage in quarrelling, fighting, gambling or social evils such as drug use, prostitution; • + Do not litter the sites and the surrounding areas • Medical checkups for workers are to be periodically performed. People with highly infectious diseases shall not be employed.		
Community Health and Safety	• The Contractors are required to comply with Circular No. 22/2010/TT-BXD by the Ministry of Construction on labor safety in construction operation; • In case of epidemic outbursts, the Project shall cooperate closely with the local authority to carry out required mitigation and control measures;	Circular 22/2010/TT-BXD of MOC on safety in construction	- Investment owner - Contractors - Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	• Fence centralized construction sites with solid materials of at least 2m high; • Place warning signs and fence open pits and channels to prevent accidents; • Provide sufficient lighting when construction is carried out at nights; • Apply speed limit at 20km/h within 200m from the construction; • Where possible, place the machines generating high level of noise as far as possible from residential houses and public areas so as noise level is kept below 70dBA; • Use static compactors when constructing near weak structures.		
Workers' Health and Safety	• Provide training to workers on environment, safety and health, including raising awareness on HIV/AIDS and other infectious diseases. • Provide adequate protective clothing and gears such as masks, helmets, boots/ shoes, gloves, goggles, belts, life vests, lifebuoys, etc. (depending on work nature) and request the workers to use when working. • Install and maintain power lines, switches etc. safely at site offices, construction sites and camps. Do not lay electrical cables on the ground or water surfaces. Provide safe plugs for electric wires. Place outdoor electric panels in protection cabinets. • Apply speed limits to vehicles traveling inside construction sites • Provide fire extinguishers, first aid kits, and medicine cabinets with medicines for common local diseases at site offices and camps. • Provide the workers' camp with clean water, electricity and mobile toilets. Protect workers' beds with mosquito nets. • Clean up the camp, kitchen, bathing place and mobile toilets regularly and keep them in good hygienic conditions. Clear flows of drainage ditches around the camp periodically. • Store fuels and chemicals safely in areas with impermeable ground, roofs and surrounding banks, equipped with safety warning signs located at least 20m from the camps and at the end of prevailing winds.	Law on labor safety and sanitation 84/2015/QH13	- Investment owner - Contractors - Supervision Consultant
Hazard Risk	• Arrange electrical lines in a safe manner, do not place wires on the ground or without proper plugs. Protect electrical panel placed outside from weather and for safety; • Store oil, fuel and chemicals at least 10 m from workers' accommodation and Contractor's Site office. Store these hazardous materials on waterproof floor, bound and roofed. Place warning signs at such storage areas;	Law on labor safety and sanitation 84/2015/QH13	- Investment owner - Contractors - Supervision Consultant

Environmental and social impact	Mitigation measure	Regulation/standard	Responsible unit
	• In case of accidental leakage or spillage of diesel/ chemicals/ chemical wastes, the Contractor(s) shall follow response procedures immediately: - The person who has identified the leakage/spillage shall immediately check if anyone is injured and shall then inform the Contractor(s), Supervision Engineer and PMU; - The Contractor(s) shall ensure any injured persons are treated and assess what has spilled/ leaked; - Should the accidents/ incidents generate serious environmental pollution (e.g. spillage/ leakage of toxic or chemicals, large scale spillage/ leakage, or spillage/ leakage into the nearby water bodies, the Contractor(s) shall immediately inform the PMU; - In such cases, the Contractor(s) shall take immediate actions to stop the spillage/ leakage and divert the spilled/ leaked liquid to nearby non-sensitive areas; - The Contractor(s) shall arrange maintenance staff with appropriate protective clothing to clean up the chemicals/ chemical wastes. This may be achieved through soaking with sawdust (if the quantity of spillage/ leakage is small), or sand bags (if the quantity is large); and/ or using a shovel to remove the topsoil (if the spillage/ leakage occurs on bare ground); - Depending on the nature and extent of the chemical spill, site evacuation may be necessary; - Do not flush spilled chemicals to local drainage systems. Instead, sawdust or sandbags used for clean-up and removal of contaminated soil shall be disposed off by following the stipulated procedures for chemical waste handling and disposal; - The Contractor(s) shall prepare a report on the incident detailing the accident, actions taken, any pollution problems and recommended measures to prevent similar accidents in future. The incident report shall then be submitted to the Supervision Engineer and the PMU for review and record. The incident report shall also be submitted to DONRE, if required; - In case of accident, the Contractor should immediately cease the execution, provide first aids for involved victims and move them to the nearest health center, then report to the Supervisor and the Investor.		

6.3.3. Type-Specific Mitigation Measures

(i)Drains and Sewers

Excavation for pipeline installation will be implemented in stages, following the rolling method:

- Before construction commencement, carry out field survey to identify the existing weak structure or permanent structures but at risks of being cracked/collapsed due excavation for pipeline construction/installation, take photos and make record. Propose appropriate construction method and special mitigation measurs to avoid or fully address the risks.
- Ensure construction quality control and roadsurface reinstatement after backfilling and compaction so as the ground is not sink/collasped after construction is completed
- Minimise carrying out construction activities and arrange staff to guide traffic during peak hours from 7 am to 8 am and 4 pm to 6pm
- Apply speed limit at 10km/h at sites, arrange staff to guide traffic where the pipes or wastes are being loaded, unloaded or placed into the trench
- Put and maintain bulletin boards at the construction site containing the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work;
- During drain construction at roads where there are offices, schools, and business households, temporary access must be provided over excavation trenches to ensure safety, especially for pupils and business households;
- Allowances are provided for 200 affected business households along the road. The allowance amount is VND 30,000,000 per household as per Decision 22/2014/QD-UBND Quang Binh, equivalent to 30% of one-year, tax-excluded average income;
- Successive construction will limit impacts on daily activities and business of the local people living along the alignments.
- Develop and implement a plan for successive construction, with each 50m section for the wastewater sewers and 300m for the stormwater sewers;
- Restore the site of each completed construction within 24 hours. In sections to be asphalted, asphalting must not exceed 3 weeks from the date of site restoration. After stormwater drainage lines are installed, carry out backfilling immediately in accordance with the technical design requirements before starting excavation for the next section;
- Put fences, sign boards, warning boards, beacons, and barriers along the ditches and roads under construction in accordance with current regulations. Place the sign boards with writing "Sorry for any conveniences caused" in densely populated areas with many restaurants, hotels, etc;
- Deploy staff to watch for the traffic and give instructions and warnings, especially when vehicles come in and out of the construction sites or stop for loading and unloading of materials and waste;
- Neatly gather materials and wastes, avoiding encroachment on existing roadways, sewers, and drainage manholes. Collect thoroughly the excavated soil falling in existing stormwater manholes and drains;
- Immediately transport the excavated soils to the designated areas outside the construction sites;

- Coordinate with the relevant authorities before the sewers crossing the streets to arrange for traffic channelization if necessary. In case the construction area would take up only 50% of the road width, carry out the construction activities in one half of the pavement, with the other half reserved for vehicle circulation. Carry out construction of the road-crossing sewers at the times of light traffic as at night, during which lighting must be properly provided;
- Avoid construction activities that may generate loud noise at noon, midnight or in the early morning, in areas near residential areas. If construction is planned to be carried out at night, inform the community at least 2 days in advance;
- Clean the construction sites and tidy up after every construction session;
- Install temporary access to give access to roadside houses and shops, affected by ditch excavation;
- Use wall piles in the excavated pits and ditches with a depth of 2.5m and over. Check the bearing walls and reinforce to ensure the stability of the excavated pits;
- Fence the CSOs to avoid fall of people, especially the children;
- Backfill the excavated ditches and pits and reinstate the pavements in the soonest possible time;
- For tertiary sewers to be located in alleys, provide temporary walkways or ground surfaces, do not gather materials, and do not use large-sized construction vehicles and means in such areas.

(ii) Pumping Stations

- Place and maintain bulletin boards at the construction site, containing the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work;
- Place corrugated iron enclosures with a minimum height of 2m around the construction site;
- Fence off the construction sites by iron sheets 2m high to ensure safety for people;
- Place warning signs of construction site, deep pits, and speed limits on the section passing the construction site;
- Use Larsen sheet piles to prevent wall slumping;
- Gather materials and excavated soils around foundation pits and properly monitored to ensure minimum scope of disturbance;
- Collect wastes and construction materials within 20m around pumping stations every day;
- Provide ladders for workers for safe access to and operations in deep pits.

(iii) Dredging and Embankment Lining of Cau Rao River

- Avoid dredging in the rainy season, from September to December, in order to maintain drainage function of the river;
- The Contractor shall prepare a Contractor's Dredging Management Plan (CDMP) and submit to the Supervision Consultant and PMU for review and approval before carrying out the works. The dredging plan shall indicate clearly:
  - The Scope of Works in the Contract package, dredging method and schedule,

- Water users that may be affected by the dredging and embankment lining
- the dredging volume, water quality and the characteristics of dredged materials; particularly water should be tested for pH,DO, TSS, BOD, salinity etc. ; heavy metals including pH, Hg, As, Cd, Cu, Pb, Zn and Cr, Organic Materials and Mineral Oils must be tested for sediment. one sample of water and one sample of sediment sample must be taken and tested for each contract package
- Process for temporary storage of dredged materials and plan for pollution control on-site
- Materials uploading and transportation method to the final disposal site: indicate proposed route of the transport from the dredged site to the disposal area, time of operation, type of vehicles/trucks
- Schedule to inform the nearby communities about the project, disclosure of name and contact number for possible complaints.
- Potential social and environmental impacts, including the site-specific impacts and risks of dredging
- Mitigation measures to address the potential impacts and risks.
- final disposal plan;
- Environmental monitoring plan.

- In addition to relevant mitigation measures for common construction impacts, the dredging plan shall meet the following requirements:
  - Coffer dams are built before dredging to separate the construction site with the remaining sections of the Cau Rao river;
  - Disturbance to the ground and on riverbed is kept at minimal; Monitoring is carried out regularly ensure temporary storage of dredged materials in abandoned aquaculture pond would not cause pollution to the surrounding; sedimentation trap is installed surrounding these ponds;
  - Brackish wastewater leaked from dredging materials will be led to flow back into the Cau Rao river;
  - During dredging time, since the flows are low, pipes will be used to direct the runoff discharged from the existing balancing lake and seven stormwater drains to the downstream of the Cau Rao river;
  - When storm is forecasted, dredging or embankment lining activities will be limited, site protection measures are implemented; all construction activities will be halted in stormy weather ;
- Dredging equipment must be operated at slow speed in intervals to allow sedimentation;
- Provide warning signs at dangerous areas, for example, underflows, erosion points, or deep excavation;
- Specified safety equipment such as lifebuoys are provided to the workers and force the use when working in the water. Assign observers throughout work shifts for timely rescue in case of emergency;
- Dai Giac pagoda is located 200m from the dredging area and is a sensitive receptor. Construction schedule should plan to limit construction activities on the first and the full moon days of lunar months; tidy up the site regularly, spray water to mitigate dust at least twice a day in hot and rainy day, do not park construction plants or load materials within 50 m from the pagoda gate. Workers should be informed about the requirements to limit impacts to the pagoda;

- Wet dredged sediment with salinity of 10.‰ will be stored temporarily at the abandoned aquaculture ponds adjacent to the dredging section (as illustrated in Figure 1.10). Each pond is 500m^2 large, 1.5 m deep, 750m^3 in capacity. Before storing the dredged sediment, the Contractor shall dry the pond by pumping the water into the river, and create path for leakage water to go back to the Cau Rao river. After 3-5 days in the lake, dredged sediment will be transported to Cau Cup disposal site;
- Saline dredged materials and soil will be disposed of in a separate areas at the Cau Cup landfill; the bottom and the surroundings of the disposal areas shall be lined with impermeable materials, surface runoff is led to the existing drains so as it can be diluted before entering waterbodies;
- When salinity in the dredged materials (at 30 cm deep) is reduced to below 2‰ (at which most plants can tolerate), apply top soil at least 30 cm thick and plant trees on the top.

Figure 6.1: Temporary Storage Area for Dredged Sediments at Cau Rao River

(Dredged Materials Management Phan are presented at Annex 07)

(iv)Bridge

- The bridge works shall be scheduled to avoid the high river flow season;
- The PMU and the Contractor shall co-operate with Electricity Company and water supply companies for relocation of the existing 24KV electric poles at the two ends of the bridge and the existing water supply pipelines which is 2m from the bridge;
- The Contractor shall be required to prepare specific Environmental, Health and Safety Plan (EHSP) before the demolition of the existing bridge and construction of the new bridge. At minimum, the EHSP shall satisfy the following requirements;
- Descriptions on measures for spill prevention, and sedimentation control, surface water flow diversion, reinstatement, etc.
- Local people shall be informed about the block off and demolition of the existing bridge with at least two weeks notice.
- Signboards and fences shall be placed and maintained to safely block off access to the two ends of the existing bridge. Allocate staff to guard the site 24 hours per day. Ensure adequate lighting at night time.
- Signboard directing traffic diversion shall be installed in 23-8 Road (600m from Cong Muoi bridge) before the existing Cong Muoi bridge is blocked off for demolition and reconstruction;

- Life vests and protective equipment are provided to the workers and enforce the use when working in or above water surface, especially during construction of bridge abutments (2-3m high above the water surface);
- For bridge construction, the waste shall be controlled strictly to restrict discharge or dumping of any wastewater, slurry, waste, fuels and waste oil into the water. All these materials must be collected and disposed of on land at the banks. The slurry and sediment shall also pump to the banks for disposal and shall not be allowed to discharge to the rivers directly;
- Reinstatement of watercourse crossings;
- After bridge construction, the works area shall be reinstated.
- Concrete mixing directly on the ground shall not be allowed and shall take place on impermeable surfaces;
- All runoff from batching areas shall be strictly controlled, and cement-contaminated water shall be collected, stored and disposed of at the approved site;
- Unused cement bags shall be stored out of the rain where runoff won't affect it; Used (empty) cement bags shall be collected and stored in weatherproof containers to prevent windblown cement dust and water contamination.;
- All excess concrete shall be removed from site on completion of concrete works and disposed of. Washing of the excess into the ground is not allowed. All excess aggregate shall also be removed.
- Specific mitigation measures shall be applied to minimize the potential impacts on the Dai Giac pagoda (located 200m from Cong Muoi bridge): cover and wet the demolishing area to prevent dust, the wastes shall be transported to a disposal site within 24 hours; no demolishing activities allowed on the first and the full moon of lunar months, a workers' camp must be as far as possible and not less than 300m from the pagoda. The service road passing the pagoda must be clean up every day, water must be sprayed at least twice a day in hot day, and construction plant and vehicles are prohibited from parking within 20 m from the pagoda gate;

(v)School sanitation and public sanitation facilities

- Put and maintain bulletin boards at the construction site, containing the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work.
- Inform the school boards of directors in advance of the construction plan to cooperate in management of school students, security, and safety during construction.
- Assign security guards around the construction sites so as to warn pupils in due time against approaching the construction site.
- Place fences around the work site and place warning signs on the fence; water the existing sanitation blocks before and during demolition to limit dust.
- If possible, provide separate entrances and exits for waste and material trucks.
- Schedule demolition of the existing toilets beyond study hours. Fence off the construction site with iron sheet of 2m high to limit dust and ensure safety for the school children.

- Avoid activities generating great noise or vibration such as demolition of concrete structures or driving of piles during class hours.
- Collect any wastewater generated by the construction to a settling tanks before discharging to the outside of the school.
- Schedule trucks transporting waste and materials not to enter and exit the school before the start of class hours, during school time, or just after class hours.
- Gather materials and wastes neatly during construction and dispose the wastes at the designated site within the soonest possible time and within less than 24hours.
- During construction, the contractor will be requested to shield off the site with fence walls to mitigate impacts on the school environment and safety of both teachers and pupils. Corrugated iron fence walls of 2.5m wide must also be set up to shield off the construction site for public sanitation facilities to minimize impacts on visitors and locals pedestrians entertaining themselves in the park.
- The construction site area must be tidied up daily. Only small capacity machines and equipment with low noise level generation should be used.
- Warning signs are to be placed to prevent pupils from approaching the construction site.
- Construction plans should be scheduled during school summer vacation time if possible in order to limit negative impacts on pupils and teachers.

6.3.4 Site–specific Mitigation Measures

(i) Disposal Sites

It is planned that excavated and dredged materials of the project will be disposed at Cau Cup landfill (a closed landfill, reclaimation has been being planned. The Cau Cup landfill has been being managed by the umbrellar Company in which the PMU is part of). The following measures shall be complied with during disposal process of the project:

- Post a speed limit sign at the entrance of the disposal site;
- Provide a notice stating “Only authorized persons are allowed”, limiting access by unauthorized persons to the disposal site;
- Provide truck washing area at the entrance gate. Wash or clean truck bodies before trucks leave the disposal site to ensure that no residual wastes can scatter out in roads;
- After being tipped down, disposal waste piles must be levelled and rolled out to mitigate dust emission, erosion, and washing off by wind and water as well as to limit safety risks;
- Mark clearly natural drainage areas to avoid waste disposal at such areas and to protect the ditches from being damaged or disturbed;
- As full closure of the Cau Cup has been in planning stage, the PMU will arrange for a specific area for the disposal of 13,214 m3 of saline excavated/dredge sediment of Cau Rao river (at 10.8‰). The specific location will be determine by the landfill closure engineer based on the overall layout of the landfill. Disposal of the saline materials at the landfill will comply with the following principles:
    - The dredged materials will be isolcated from the surroundings to prevent uncontrolled spreading of salinity into vegetated land and groundwater (isolation can be provided by. waterproof materials such as plastic canvas.
    - Ditches will be created surrounding the specific disposal site. Runoff passing the dredge materials will be led to the common existing drainage of the landfill so as salinity can be dilluted before reaching the receptor.

- water coming from the cell will be led to the existing drainshall be used to cover the bottom and the surroundings of the designated sediment disposal area. ditches will be built surrounding the disposal area of this
- When disposal of dredged materials is completed, a layer of 50-60cm thick of excavated soil will be applied on top of excavated soil shall be provided on top of the excavated sediment to mitigate salinity spreading via stormwater overflows which, in turn, can limit development of the floral system at the disposal site. Create and maintain drainage path for the site so as subsurface runoff (brackish) can be diluted by the runoff incoming from the other parts of the landfill.
  (although the exact location, the height and the dimensions of the land area where sediments are disposed off has not been determined, assuming disposal height is 3 m then 0.44 ha of land (which accounts for about 3% of the Cau Cup landfill's total land area) will be needed for disposal. Contributing 3% of total volume, after being diluted with the remaining 97 % of surface runoff from the cathment of the existing drainage, salinity in the combined flow would be negligible.

(ii)Along the Pipelines Alignment

Site–specific mitigation measures of the project are presented in Table 6.3 as follows:

Table 6.3: Site-specific mitigation measures for Drainage Route Locations

No.	Road	Site–specific impacts	Mitigation measures	Responsible unit
1	Ly Thai To road 	▪ Traffic disturbance because the 4.5m will be occupied on this 12m wide road. ▪ There are businesses and shops at road sides; ▪ Dong Son primary school and Con market; ▪ Land slide risk as excavated depth is 4.3m	▪ Avoid loading construction materials and waste within 20m from school gate; ▪ Remove the waste from the site in parallel with excavation/pipe installation; ▪ Place warning signs and speed limit at 10 km/h at section passing the market ▪ Clean up the road at end of working shiftswater the road section passing the school and market before peak hours: 7am, 11 am and 4 pm	- Investment owner - Contractors - Supervision Consultant
2	Le Hong Phong road 	▪ Traffic disturbance and increased safety risks as the available roadwidth is reduced from 9 m to 4.5m (in sparsely distributed population area) ▪ Dong Son No. 1 primary school;	▪ Avoid loading of materials, equipment and wastes, park vehicles or concentrations of workers within 20m from school; ▪ water the road section passing the school before peak hours: 7am, 11 am and 4 pm	- Investment owner - Contractors - Supervision Consultant
3	Ton That Tung road (Nam Ly)	▪ Traffic disturbance and increased	▪ Apply speed limit at 10km/h at sites where the	- Investment owner

		safety risks (available road width is reduced from 8 m to 4.2m); ▪ Populated area, with retail shops along two road sides; ▪ Vietnam - Cuba hospital;	pipes or wastes are being loaded/unloaded or unloaded ▪ Minimize construction at populated areas, school and hospital in peak hours ▪ Avoid loading of materials, equipment and wastes, park vehicles or concentrations of workers within 20 m from the gate of the hospital. ▪ No construction at lunch and night time.	- Contractors - Supervision Consultant
4	 Trung Truong road	▪ Traffic disturbance because the road width required for construction is 4.5m; the remaining road width is 12m; ▪ There are business and shops at road sides;	▪ Minimize construction time at populated areas, market; ▪ Remove the waste from the site in parallel with excavation/pipe installation; ▪ Clean up the road at end of working shifts	- Investment owner - Contractors - Supervision Consultant
5	 Ngo Gia Tu road	▪ Traffic disturbance because the 3.8m will be occupied on this 6m wide road. ▪ There are business and shops at road sides; ▪ Land slide risk as excavated depth is 3.35m	▪ Remove the waste from the site in parallel with excavation/pipe installation; ▪ Clean up the road at end of working shifts	- Investment owner - Contractors - Supervision Consultant
6	 Huu Nghi road	▪ Traffic disturbance because the 3.8m will be occupied on this 22m wide road. ▪ There are the DONRE, the Fire Station, and Huu Nghi hospital at road sides;	▪ Minimize construction at peak time at populated areas, station, hospital; ▪ Avoid construction activities at peak hours ▪ Avoid loading of materials, equipment and wastes, park vehicles or concentrations of workers within 20m from the DONRE, fire station, hospital; ▪ Remove the waste from the site in parallel with excavation/pipe installation; ▪ Quickly remove all materials that may obstruct the movements of fire fighting trucks in case	- Investment owner - Contractors - Supervision Consultant

			signals started in their station	
7	 To Huu road	▪ Traffic disturbance because 3.8m will be occupied on this 12m wide road. ▪ There is crowded population, food stalls/ restaurants, Nam Ly bus station at road sides;	▪ ▪ Water the road at least three time a day ▪ Avoid loading of materials, equipment and wastes, park vehicles or concentrations of workers within 10 m from restaurants and bustation ▪ Clean up the road at end of working shifts	- Investment owner - Contractors - Supervision Consultant
8	 Le Truc road	▪ Traffic disturbance because the 3.3m will be occupied on this 7m wide road. ▪ There are Hoa Hong kindergarten and the City People's Committee at road sides;	▪ Complete construction work earliest possible at the section passing the CPC office ▪ Minimize construction at peak hours 7 am to 7 am and 3 pm to 6 pm at at kindergarten and the City People's Committee; ▪ Avoid activities that generate high noise at lunch time 11am to 1 30 pm within 20 m from the kindergartenDo not load construction materials or park vehicles, do not use horns within 20m from the kindergarten and the City People's Committee; ▪ Remove the waste from the site in parallel with excavation/pipe installation.	- Investment owner - Contractors - Supervision Consultant
9	 Phan Dinh Phung road	▪ Traffic disturbance because the 4.5m will be occupied on this 12m wide road. ▪ There are shops at road sides; ▪ Bac Ly No. 1 primary school and	▪ Do not load construction materials within 20m from Bac Ly schools; ▪ Clean up the road at end of working shifts ▪ Minimize construction at peak hours 7 am to 8 am, and 4 pm to 6 pm; avoid activites generating high	- Investment owner - Contractors - Supervision Consultant

		Bac Ly No. 1 secondary school	noise during 11 am to 1 pm at the section passing the school ▪ Avoid activities that generate high noise during classroom hours at the section passing the school, These can be done during break time within school ▪ water the road section passing the school before peak hours: 7am, 11 am and 4 pm ▪ Do not load materials, and waste, park vehicles within 20 m from schoolRemove the waste from the site in parallel with excavation/pipe installation.	
10	 Hoang Dieu (Nam Ly) road	▪ Traffic disturbance because the 4.5m will be occupied on this 8m wide road. ▪ There are HHs and shops at road sides.	▪ Clean up the road at end of working shifts ▪ Remove the waste from the site in parallel with excavation/pipe installation.	- Investment owner - Contractors - Supervision Consultant
11	 Le Loi road	▪ Traffic disturbance because the 3.8m will be occupied on this 20m wide road; ▪ There are HHs and many shops at road sides; ▪ Dong Hoi General Hospital and Dai Giac Pagoda.	▪ Minimize construction at peak and sensitive hours7 am to 8 am, and 4 pm to 6 pm at populated areas, Hospital ▪ Avoid activities that generate high noise ▪ Schedule construction to avoid carrying out the section passing the Pagoda on 1st and 1th lunar month or their main festival ▪ Install fence to stop direct view from the pagoda to the construction site; ▪ Do not load construction materials within 20m from the gates of Hospital and Pagoda; ▪ Remove the waste from the site in parallel with excavation/pipe installation.	- Investment owner - Contractors - Supervision Consultant

12	 Sub-zone 9, Bac Ly	▪ Traffic disturbance because the 4.5m will be occupied on this 6m wide road. ▪ There are business and shops at road sides; ▪ soil subsident risk as excavated depth is 3m.	▪ Clean up the road at end of working shifts ▪ Remove the waste from the site in parallel with excavation/pipe installation;	- Investment owner - Contractors - Supervision Consultant
13	 Phan Huy Ich road	▪ Traffic disturbance because the 3.3m will be occupied on this 4m wide road; ▪ There are HHs and many shops at road sides;	▪ Diverting traffic flows to Diem Tan, Tran Nhat Duat, and Phan Phu Tien roads; ▪ Remove the waste from the site in parallel with excavation/pipe installation. ▪ Clean up the road at end of working shifts ▪	- Investment owner - Contractors - Supervision Consultant
14	 Tran Nhat Duat road	▪ Traffic disturbance because the 3.3m will be occupied on this 8m wide road; ▪ There are HHs and many shops at road sides;	▪ Remove the waste from the site in parallel with excavation/pipe installation. ▪ Clean up the road at end of working shifts	- Investment owner - Contractors - Supervision Consultant
15	 Nguyen Van Troi road	▪ Traffic disturbance because the 3.3m will be occupied on this 6m wide road; ▪ There are HHs and many shops at road sides.	▪ Remove the waste from the site in parallel with excavation/pipe installation. ▪ Clean up the road at end of working shifts	- Investment owner - Contractors - Supervision Consultant
16	 Truong Phap road	▪ Traffic disturbance because the 2.5m will be occupied on this 15m wide road. ▪ There are many restaurants, and hotels at road sides; ▪ Nhat Le beach;	▪ Fence off construction sites with solid fence to stop the views from outsiders ▪ Place “access restricted” and “sorry to disturb” signboards at the construction sites ▪ Remove the waste from the site in parallel with excavation/pipe installation;.	- Investment owner - Contractors - Supervision Consultant

(iii)Site-Specific Mitigation Measures for the Road and Bridges under Component 2

Table 6.4: Site-Specific Mitigation Measures for Component 2

Km	Issue/Impacts	Mitigation Measures	Responsible unit
0	Beginning point is connected with Quang Trung Road: traffic safety risks	▪ Place project information board at the junction ▪ Place signboards "Work in progress" and "Speed limit 10 km/h) at the beginning point	- Investment owner - Contractors - Supervision Consultant
50 m	Phu Hai ward's cemetery is 50m from the road: + Visual impacts, landscape + physical cultural resources + impacts on vegetation cover and trees + Worker's camps and temporary storage areas will be placed on part of the vacant land in front of the cementer	▪ Separate the construction/camp areas with solid fences ▪ Maintain access to the gate of the cemetery ▪ Do not park construction plants or load materials, wastes within 10 m from the gate ▪ Avoid damages caused to the trees, reinstate vegetation cover ▪ Limit construction work on 1st and 15th lunar month ▪ Wastewater from camp will be led though closed pipes to irrigation canal ▪ SEMP and workers codes of conducts strictly applied	- Investment owner - Contractors - Supervision Consultant
	Chu Văn An school is 200m from the road: + Traffic and Safety + Noise and dust	▪ Arrange workers to direct traffic at peak hours at the turning point to the school ▪ Strictly manage the areas within 10 from turning point to the school: + Avoid parking and loading materials + Load material neatly and clean up the area daily	- Investment owner - Contractors - Supervision Consultant
60 m	The road cut through abandoned rice field, some garbage and waste are dumped there Some houses at the far end	▪ Keep disturbed areas minimal ▪ Store top soil separately for reinstatement of disturbed areas; transport the garbage to landfill site	- Investment owner - Contractors - Supervision Consultant
0+300m	The road cut through the rice field	- Inform local community about site clearance plan so as they can plan for crop harvesting before construction commencement - Store and reuse topsoil for beneficial use	- Investment owner - Contractors - Supervision Consultant
	A feeder canal (cross section of 1,0m) and	- Build replacement canal before cutting off the existing canal	- Investment owner - Contractors

Km	Issue/Impacts	Mitigation Measures	Responsible unit
	casuarinas trees, 4-5m high, will be affected by land acquisition.	- Inform local community about site clearance plan so as they can plan for using the trees for beneficial use - Prevent materials from falling into the remaining and replacement canal during construction, clean up the affected section regularly	- Supervision Consultant
	Mimosa Pigra, an invasive plant species presence in this area.	- Mimosa must be uprooted, burnt on-site, seal the ash and disposed of separately at the landfill. - The excavated soil from areas where mimosa is observed must be transported away immediately, temporary storage near existing agricultural land is not allowed	- Investment owner - Contractors - Supervision Consultant
0+395m	The road cut through abandoned aquaculture pond	- Maintain existing drainage pattern surrounding the pond to ensure no localized flooding during construction phase; - Minimize clearance area and avoid damages to the trees;	- Investment owner - Contractors - Supervision Consultant
	The road cut through the main 20 m wide earthen irrigation canal + disturbance to irrigation service + Drainage function may be affected + some trees along the canal	- Build replacement canal before cutting off the existing canal; - Build, maintain drainage pattern surrounding the construction area to ensure no localized flooding during construction phase; - Minimize clearance area and avoid damages to the trees.	- Investment owner - Contractors - Supervision Consultant
0+500m	The road crosses the earthen irrigation feeder canal	- Build boxed drain 150x150 reinforced concrete (to maintain irrigation service) before road construction; - Manage material and wastes to avoid sedimentation caused to the existing canal	- Investment owner - Contractors - Supervision Consultant -
	The road crosses the aquaculture ponds	- Compensate the affected households before construction - Inform the affected households about construction schedule earliest possible - Minimize the potential impacts on the trees and vegetation cover to maintain green landscape as much as possible	- Investment owner - Contractors - Supervision Consultant
0+600 m	Starting point of the access to Le Ky Bridge, the road crosses Le Ky embankment with an existing path for pedestrians.	- Maintain accessibility on the existing path during construction phase - Store materials and construction plants safely in rainy season - Do not park heavy construction plant too close to dyke slop that may cause landslide/damages to the dyke	- Investment owner - Contractors - Supervision Consultant

Km	Issue/Impacts	Mitigation Measures	Responsible unit
	Camp and temporary storage area on vacant at riverside (available space very limited)	- untreated wastewater will not be discharged directly into the river -	
0+700 m	Le Ky Bridge, 212m long, 30m wide, 6 spans (7 piers), each span is 33m long, the bridge's width is 30m.	- Inform local community about the construction plan - Implement SEMP and specific measures applicable to bridge, including ensuring safety on waterway transport (small fishing boats) - Do not store materials, fuel within 20m from the river - Do not wash equipment in the river	- Investment owner - Contractors - Supervision Consultant
0+800 m	The road cuts through aquaculture ponds outside the embankment of the Le Ky river.	- Compensate the affected households before commencement - Inform the affected households about site clearance and construction plan as soon as possible so as they can plan and harvest the last crop in a timely manner	- Investment owner - Contractors - Supervision Consultant
0+ 900m	The road crosses the abandoned lagoon located between Cau Tay and Ky river.	- Build drains under the road to maintain drainage function between the two side of the lagoon	- Investment owner - Contractors - Supervision Consultant
0+ 1200m	The road cuts through rice fields intersected with aquaculture ponds	- Maintain access to the remaining agricultural land during construction - Prevent construction materials and wastes from falling into rice field and aquaculture pond - Minimize disturbed areas	- Investment owner - Contractors - Supervision Consultant
0+ 1300m	The location of planned West Bridge with one span, 24m long and 21m wide. Lots of mimosa pigra are found in this area.	- If mimosa is presence at the disturb area, they must be uprooted, burnt on-site, seal the ash and disposed of separately at the landfill. - The excavated soil from areas where mimosa is observed must be transported away immediately, temporary storage near existing agricultural land is not allowed - Do no store materials, fuel within 20m , from the river - Do not wash equipment in the river	- Investment owner - Contractors - Supervision Consultant

Km	Issue/Impacts	Mitigation Measures	Responsible unit
0+ 1340m	The road crosses aquaculture ponds	- Maintain access to the remaining agricultural land during construction - Prevent construction materials and wastes from falling into rice field and aquaculture pond - Minimize disturbed areas	- Investment owner - Contractors - Supervision Consultant -
0+ 1440m	Traffic safety risk at the junction with the road (The new road will end at the intersection with Dong Hoi city bypass. There are no residents but two farms)	- As per the design, this will be a big intersection between the project road and the city bypass to ensure safety during operation phase - Minimize disturbance to the grass, landscaping the intersection with native plants.	- Investment owner - Contractors - Supervision Consultant
		- Place signboard to inform work in progress and speed limits and the entrance - clean up the road 50 m from each direction to prevent traffic safety risks	-

(iv)Site- Specific Mitigation Measures for Sensitive Receptor

Table 6.5: Site-Specific Mitigation for Sensitive Receptor

No.	Sensitive receptor	Issues/Impacts	Specific mitigation measures	Responsible unit
1	Dai Giac pagoga, 200 m from dredging area and Cong Muoi bridge (demolish the existing and build a new one) 	Disturbance to religious activitities, particularly on 1st and 15th lunar months Visual and aesthetic impacts Noise from bridge demolition and pile driving affect worhipping activities Disturbance to the monks and visitors	PMU will inform the pagoda managers at least one week in advance about construction schedule ▪ The camps and site office must be at least 100 m from the pagoda ▪ Environmental training for the workers includes codes of conducts when working in pubic areas and sensitive receptors such as pagodas ▪ Demolition and pile driving activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the monks ▪ No materials or wastes will be placed within 50 m from the boundary of the pagoda ▪ Fence the bridge construction side with 2.5 m solid fence to adequately block the view from the pagoda to the construction site. ▪ Clean up the disturbed areas daily, if it is within 100 m from the pagoda ▪ Construction plants and trucks will not be parked within 100 m from the boundary of the pagoda ▪ Halt construction activities if there are complaints from the pagoda, discuss and carry out corrective measures are implemented satisfactorily to the complainer. The case must be documented	- Investment owner - Contractors - Supervision Consultant
2	Tam Toa Parish (is located near Thong Nhat road which is the transport route of dredged materials and waste to Cau Cup landfill) 	Transport trucks will increase traffic risks to travelers along this road; dust, emissions, and noise generated by transport trucks will affect religious activities of the parishioners at weekends, and cause impacts on the overall landscape of the road as well the view of Tam Toa Parish Parishioners worship on Sunday morning	▪ Inform the Parish of the construction schedule and the potential impacts on the Parish such as waste, dust, and noise, traffic disturbance, at least 01 month before start of the construction. ▪ Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. ▪ Trucks must be slown down to 20 km when passing the Parish at the weekend ▪ Environmental training for the workers includes codes of conducts when working in pubic areas and sensitive receptors such as pagodas ▪ No materials or wastes will be placed within 50 m from the boundary of the Parish gate ▪ Construction plants and trucks will not be parked within 100 m from the boundary of the Parish on Sunday morning and during their festival days	- Investment owner - Contractors - Supervision Consultant

		and during religious festivals	▪ Revise construction schedule and method if reasonalbe request is made from the Parish ▪ Halt construction activities if there are complaints from the Parish, discuss, investigate the nature of the complaints and carry out corrective measures are implemented satisfactorily to the complainer. The case must be documented	
3	Phu Hai Ward Cemetery (Related to the component 2 contruction) 	The grass cover in front of the cemetary is disturbed. Access to the cemetery may be obstructed.	▪ Separate the construction/camp areas with solid fences. ▪ Maintain access to the gate of the cemetery. ▪ Do not park construction plants or load. materials, wastes within 10 m from the gate ▪ Avoid damages caused to the trees, reinstate vegetation cover . ▪ Limit construction work on 1st and 15th lunar month. ▪ Wastewater from camp will be led though closed pipes to irrigation canal. ▪ SEMP and workers codes of conducts strictly applied.	- Investment owner - Contractors - Supervision Consultant
4	The Schools (Related to the construction school sanitation blocks and Pipeline installations)  	▪ Noise and dust ▪ Safety of students and teachers ▪ Traffic disturbance and increased traffic safety risks	▪ Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. ▪ If possible, implement the construction activities during the school summer vacation. ▪ Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering. ▪ Teachers to be informed of construction operations to keep pupils off the site during their break time. ▪ Prohibit use of construction methods that cause noise during school learning hours. ▪ Prohibit gathering of construction materials in front of the school. ▪ Sprey sufficient water to suppress dust during dry and windy days at least three times a day at site. ▪ Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. ▪ Prohibit construction of workers camps within 2 km from the school. ▪ Sett up construction and traffic warning signs at the construction site. ▪ Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations,	- Investment owner - Contractors - Supervision Consultant

			especially when school children go to and leave the school around construction area. ▪ Tidy construction materials and stockpiles every working session. ▪ Cover the incomplete trenches under construction at day's end. ▪ Providing night lighting system with luminously painted fence and night lamp. ▪ Immediately addess any issue/problem caused by the construction activities and raised by the school management.	

6.3.5.Operation Phase

Table 6.6: Mitigation Measures for Operation phase

No	Area /Activity	Site–specific impacts	Mitigation measures	Responsible unit
1	Duc Ninh WWTP and Sewer System	- Good operational practice; - Check and maintain treatment facilities periodically to ensure the best system performance. - Install an online monitoring system at the WWTP to control wastewater influents, quality of the influents and effluents at the WWTP; - Contain wastes (sludge and domestic solid wastes) in standardized containers before transporting to disposal sites to minimize dispersion of gases and solid wastes into the environment; - Train the worker about safety and health during operation; - Emergency procedures.	- QCVN 14:2008/BTNMT - QCVN 08-MT:2015/BTNMT	Investment owner
2	Solid Waste Collection System	As discussed in Section 2.4.5, the solid waste collection system in Dong Hoi has been running quite well. Ly Trach landfill has been improved under the CCESP. With additional equipment provided, URENCO has been and will continue complying with the Standard of Operation (SOP)/ Operation Manual (OM) for landfill operation.	-Decree 59/2007/NĐ-CP; -Decree 36/2015/TT-BTNMT.	Investment owner
3	School and Public Toilets	Before taking over the toilets, the schools shall be required to commit to maintain such facilities as per the O&M manual. The public toilets will be handed over to the Beach Management Unit that shall make commitments on keeping the toilets clean and safe for local people, including the disable, controlling odor release, ensuring no negative impacts on urban aesthetic view, and operating and maintaining the toilets as per the O&M manual.		Beach Management Unit School Management
4	Road and bridge	Mitigation measures for operation impacts have been or will be incorporated into the design (junction, slope protection, drainage, lighting and landscape, etc.). The road management	Circular: 50/2015/TT-BGTVT	Receiving units Traffic police

		authority should maintain traffic sign system and road surface conditions to maintain road safety and limit emissions from transportation means.		

6.4. ENVIRONMENTAL MONITORING PLAN

6.4.1. Monitoring of Contractor's Environmental Performance

Three levels of monitoring include daily monitoring, periodical monitoring and community monitoring which will be implemented as follows:

1. Daily monitoring: will be carried out by the Construction Supervision Consultant appointed by the PMU. The Construction Supervision Consultant (CSC) will present monitoring results in the project implementation progress report.
2. Periodical monitoring (monthly and quarterly) will be implemented as a part of the overall environmental monitoring plan (EMP) carried out by the Independent Monitoring Consultant, local government authorities including DONRE and other relevant departments.
3. Community monitoring: the local community also monitor the implementation of Government's regulations with technical support of the PMU.

6.4.2. Environmental Quality Monitoring

Monitoring of environmental quality is carried out throughout three project phases. The parameters, frequency and monitoring locations are summarized in the table below:

Table 6.7: Scope and Parameters of Environmental Monitoring

No	Item	Pre-construction	Construction	Operation
I	**Air, noise and vibration monitoring**			
	1. Parameters	Dust, noise, CO, SO2, NO_x, H_2S, NH_3	Dust, noise, CO, SO2, NO_x, H_2S, NH_3	Dust, noise, CO, SO2, NO_x, H_2S, NH_3
	2. Frequency	Once before construction	Once every 06 months	None
	3.Applicable standards	QCVN 05: 2013/BTNMT, QCVN 06: 2009/BTNMT; QCVN 26: 2010/BTNMT; QCVN 27: 2010/BTNMT		
	4.Monitoring locations	3 samples	3 samples	
II	**Surface water quality monitoring**			
	1. Parameters	pH, BOD_5, COD, TSS, DO, T-N, T-P, NH_4^+, Coliform, oil and grease	pH, BOD_5, COD, DO, TSS, T-N, T-P, NH_4^+, Coliform, oil and grease	pH, BOD_5, COD, DO, TSS, T-N, T-P, NH_4^+, Coliform, oil and grease
	2. Frequency	Once before construction	Once every 06 months	Once every 06 months
	3.Applied standards	QCVN 08:2008-BTNMT		
	4.Monitoring locations	04 samples (Sampling locations given in the annex part)	04 samples	
III	**Domestic wastewater quality monitoring at Duc Ninh WWTP**			
	1. Parameters	pH, BOD_5, COD, TSS, DO, T-N, T-P, NH_4^+, Coliform, oil,	pH, BOD_5, COD, DO, TSS, T-N, T-P,	pH, BOD_5, COD, DO, TSS, T-N, T-P,

No	Item	Pre-construction	Construction	Operation
		grease, heavy metals	NH_4^+, Coliform, oil, grease, heavy metals	NH_4^+, Coliform, oil, grease, heavy metals
	2. Frequency	Once before construction	Once every 06 months	Once every 06 months
	3.Applied standards	QCVN 14:2008/BTNMT		
	4.Monitoring locations	04 samples	04 samples	04 samples
IV	**Sedimentation quality monitoring**			
	1. Parameters	As, Hg, Cu, Zn, Pb, salinity	As, Hg, Cu, Zn, Pb, salinity	As, Hg, Cu, Zn, Pb, salinity
	2. Frequency	Once before construction	None	None
	3.Applied standards	QCVN 43:2012/BTNMT		
	4.Monitoring locations	3 samples	3 samples	
V	**Aquatic biological monitoring**			
	1. Parameters	Numbers, density of plants, planktons, large invertebrates.		
	2. Frequency	01 time before construction		02 during operation phase (6th and 12th month after dredging is completed)
	3.Monitoring locations	- Sample 1: the dredging section of Cau Rao River - Sample 2: bridge construction section of Le Ky river		- Sample 1: the dredging section of Cau Rao River
VI	**Erosion monitoring**		Throughout the construction: slope, cut and fills, embankment	

6.4.3. Reporting Requirements

Monitoring reports must be submitted during the social and environment monitoring program as following:

Table 6.8: Reporting Requirements

No.	Report title	Quantity			Prepared by
		Preparation phase	Construction phase	Operation phase	
1	Monthly environmental monitoring reports (including erosion monitoring)	1	24	2	Construction supervisor
2	Quarterly environmental monitoring reports (including erosion monitoring)		8	1	Construction supervisor
3	Biological monitoring reports	1		1	Construction supervisor
	Total	2	32	4	

6.5. ROLES AND RESPONSIBILITIES FOR ESMP IMPLEMENTATION

6.5.1. Implementation Arrangement

The following key stakeholders will take part in the implementation of Environmental and Social Management Plan:

- The Project owner: the PMU of Dong Hoi city (Dong Hoi PMU);
- Engineering Design Consultant
- Construction Supervision Consultants (CSC)/Environmental Supervisors (ES);
- Independent Environmental Monitoring Consultant (IEMC);
- Construction Contractors;
- Local communities;
- The schools where toilets are constructed;
- The PPC, CPCs, Resettlement Committees
- The MONRE
- The World Bank (WB)

The relationship among relevant stakeholders for the environmental management of the Project is presented in below diagram:

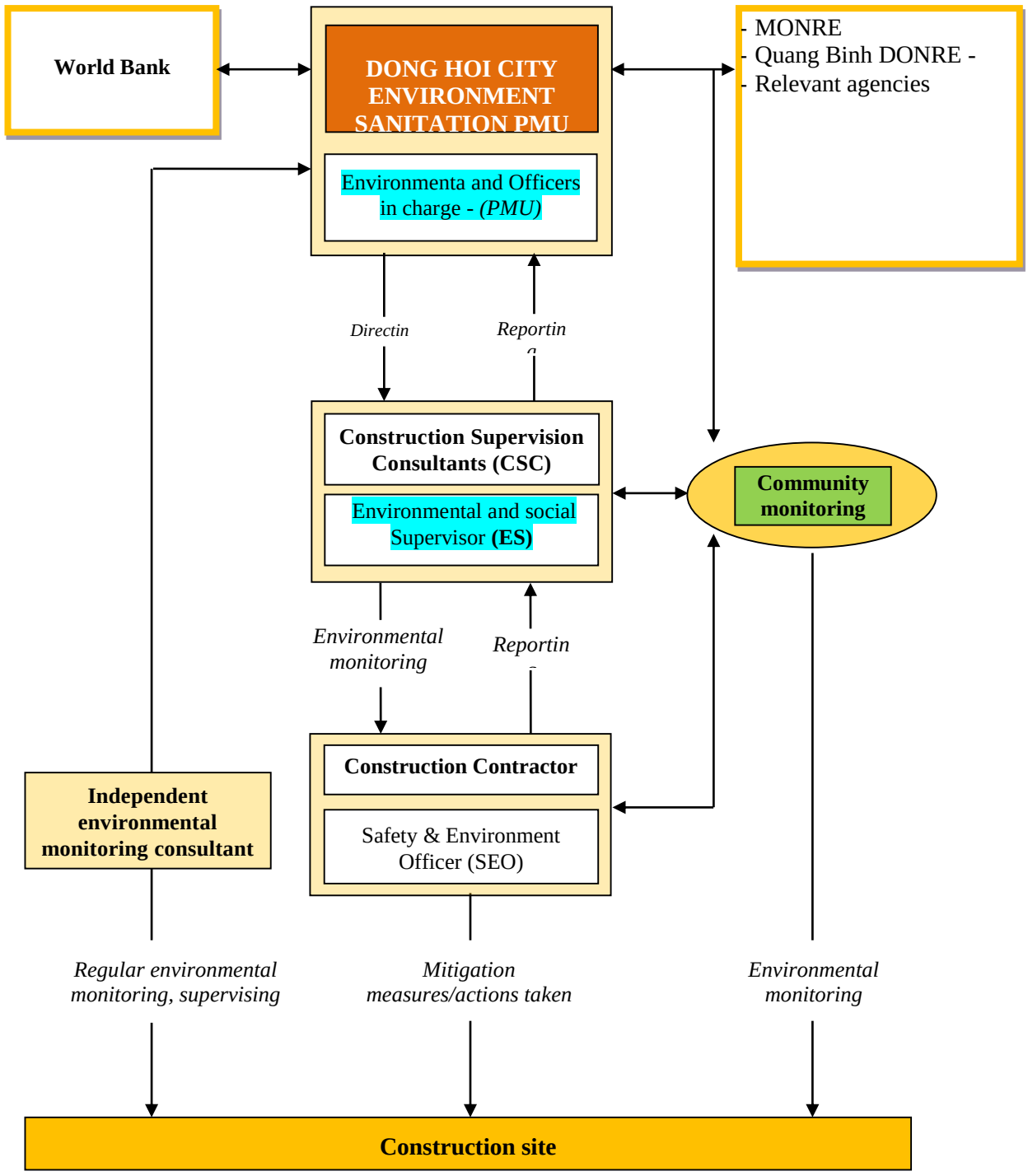


Figure 6.2: Project Environmental Management System Diagram

Specific responsibilities of relevant stakeholders are presented in Table 6.9 below:

Table 6.9: Roles and Responsibilities of Social and Environmental Management Agencies During the Project Preparation and Construction Phases

Unit	Environment related responsibilities
Project Management Unit (PMU)	The PMU is the project implementation unit being responsible for the overall supervision of the Project, including environmental compliance, and taking main responsibilities for environmental issues in various project phases. The PMU shall ensure that the environmental management system is established and the responsibilities of relevant stakeholders are reasonable. The PMU will be assisted by the CSC and IEMC in overall monitoring and implementation of the ESMP.
Environmental Officer in charge (from Dong Hoi PMU)	The PMU will assign an Environmental Officer (EO) in charge to help solving environmental issues induceof the Project, supervising the environmental compliance with the WB safeguard policies and Vietnam's regulations in various project phases. The EO will advise the PMU leaders on solutions for environmental issues to ensure the compliance with WB's safeguard polices and regulations stipulated by Vietnamese Government. The EO will coordinate with the CSC team and the contractors to carry out due diligence review of borrow pits, quarries identified during construction phase and decide whether they are eligible for use in the Project
Social and Resettlement Office	The PMU will assign at least a Social and resettlement Officer (EO) in charge to help solving social and resettlement issues of the Project, supervising the compliance with RPF and RAP, participate in investigation and solvings complaints related to social issues and land acquisition.
Construction supervision consultant (CSC)/	The CSC team will include at least one Environmental Supervisor (ES) in charge of environmental, health, safety, and traffic issues of the Project CSC/ ES will be responsible for overall monitoring of construction activities and make sure that the contractors undertake the mitigation measures specified in the contracts. The ES monitor and supervising the contractors to ensure compliance with ESIA. When environmental issues are arisen or when there are complaints, the CSC will direct the contractor to carryout corrective measures. The CSC will also arrange for environmental quality monitoring to be carried out and prepare periodical monitoring reports. CSC/ ES shall report regularly to the PMU on monitoring results.
Independent environmental monitoring consultant (IEMC)	Support the PMU to establish and operate the ESMP. Monitor environmental compliance of project and prepare reports at frequency regulated in the TOR. Carry out supplementary measurement when required. Provide professional, objective and independent guidance on the Project environmental related activities.
Construction Contractors	After contract signing, the contractor will prepare SEMP based on ESIA and contractual specifications and submit to the CS for review and approval The Contractor shall assign a staff in charge of environmental, occupational health and safety issues during construction phase. The Construction Contractors will implement the mitigation measures specified in the SEMP and construction contracts to ensure fully compliance with the Project are ESIA. The Construction Contractors shall work under supervision of the CSC, ES, EO and carry out corrective measures when required. The contractor will be responsible for facilitating the training activities provided to the workers by the IEMC, CSC and/or PMU, including trainings on HIV/AIDs ensure that the workers fully attend the trainings designed for them.

Unit	Environment related responsibilities
	The contractor will be responsible for facilitating the monitoring activities carried out by various stakeholders including IEMC and communities.
Local communities	Communities in the project areas where construction take place will take part in environmental monitoring in accordance with Decision No. 80/2005/QD-TTg.
Quang Binh DONRE	- Carry out monitoring on the project environmental compliance as and when needed
MONRE	- Review application and issue treated wastewater discharge license
The WB	- Monitor ESMP compliance

6.5.2. Environmental Compliance Framework

6.5.2.1. Environmental Duties of the Contractors

The contractors firstly shall adhere to minimize impacts that may result from the project construction activities and secondly, apply the mitigation measures stated in the ESMP to prevent harm and nuisances on local communities and the environment caused the construction and operation phases.

Remedial actions that cannot be effectively carried out during construction should be implemented upon completion of the works (and before issuance of the Works Acceptance Certificates)

The Contractors' duties include but not limit to:

- Comply with relevant legislative requirements governing the environment, public health and safety;
- Work within the scope of contractual requirements and other tender conditions;
- Organize representatives of the construction team to participate in the joint site inspections undertaken by the Environmental Supervisor (ES) of the CSC;
- Carry out any corrective actions instructed by the Environmental Officer (EO) of the PMU and the ES;
- In case of non-compliances/ discrepancies, carry out investigation and submit proposals on mitigation measures, and implement remedial measures to reduce environmental impacts;
- Stop construction activities, which generate adverse impacts, upon receiving instructions from the EO and the ES. Propose and implement corrective actions and carry out alternative construction methods, if required, to minimize the environmental impacts; Non-compliance by the Contractor will be cause for suspension of works and other penalties until the non-compliance has been resolved to the satisfaction of the EO and the ES.

After contract signing, based on CCSEP ESIA and contractual conditions, the contractors will prepare a Site-specific Environmental Management Plan (SEMP) for each contract packages. For the packages that involves dredging activities, the Contrators will also be required to prepare a Dredging Management Plan (DPP) and submitted to the CSC and PMU for review and clerance.

In case the contractor propose to use source of raw materials that have not been covered in subproject ESIA, the contractor will report to the CSCs and PMUs and coordinate with them in carrying out due –dilligence environmental review of these materials sources to assess their

compliance to national environmental requirements. Only complied sources can be unsed under CCSEP.

6.5.2.2. Contractor's Safety and Environment Officer (SEO)

The Contractor shall be required to appoint a competent individual as the Contractor's on-site safety and environment officer (SEO). The SEO must be appropriately trained in environmental management and possess necessary skills to transfer environmental management knowledge to all personnel involved in the contract. The SEO will be responsible for monitoring the contractor 's compliance with the ESMP requirements and the environmental specifications. The duties of the SEO shall include but not limit to the following:

- Carry out environmental site inspections to assess and audit the contractors' site practice, equipment and work methods with respect to pollution control and adequacy of environmental mitigation measures implemented;
- Monitor compliance with environmental protection measures, pollution prevention and control measures and contractual requirements;
- Monitor the implementation of environmental mitigation measures;
- Prepare audit reports for the environmental monitoring data and site environmental conditions;
- Investigate complaints and recommend any required corrective measures;
- Advise the contractor on environment improvement, awareness and proactive pollution prevention measures;
- Recommend suitable mitigation measures to the contractor in the case of non-compliance. Carry out additional monitoring of noncompliance instructed by the ECO/ES;
- Inform the contractor and ECO/ES of environmental issues, submit contractor's ESMP Implementation Plan to the ECO/ES, and relevant authorities, if required;
- Keep detailed records of all site activities that may relate to the environment.

6.5.2.3. Independent Environmental Monitoring Consultant (IEMC)

The Independent Environmental Monitoring Consultant (IEMC) contracted by PMU shall carry out the monitoring.

- Provide training for PMU and the CSC, and the representatives of the Contractors on socio-environmental, health and safety issues related to construction;
- Arrange for HIV /Aids training for the contractor's workers, CSC team and PMU officers;
- Evaluate environmental quality at the areas affected by the construction activities (including site observations, reviewing environmental quality data provided by the CSC, review of other available documents, and supplement sampling if necessary);
- Review contractor's environmental compliance including the implementation of mitigation measures and documentation;
- Review PMU and CSC compliance to ESMP.
- The IEMC will also provide technical advice and assistance to the PMU and the EO in environmental matters.

6.5. 2.4. Environmental Supervision during Construction

During the construction phase, at least a qualified Environmental Supervisor as a team member of the Construction Supervision Consultant (CSC) shall carry out environmental supervision as part of construction supervision. The CSC is responsible for inspecting and supervising all construction activities to ensure that mitigation measures adopted in the ESMP are properly implemented, and that the negative environmental impacts of the Project are minimized. Specifically, the ES will:

- Review and assess on behalf of the PPMU whether the construction design meets the requirements of the mitigation and management measures of the ESMP;
- Review and clear contractor's SEMP;
- Coordinate with EO in reviewing environmental compliance at newly proposed borrow pits and quarries and advise PMU on whether these are eligible for use by the Project;
- Verify and confirm with PMU environmental supervision procedures; parameters, monitoring locations, equipment and results;
- Supervise site environmental management system of the Contractors, including their performance, experience and handling of site environmental issues, and provide corrective instructions if needed;
- Prepare report on ESMP implementation status to the PPMU and prepare environmental supervision statement during the construction phase; and
- Reivew payment requests related to environmental mitigation costs if applicable

6.5.2.5. Compliance with Legal and Contractual Requirements

The constructions activities shall comply not only with contractual environmental protection and pollution control requirements but also with environmental protection and pollution control laws of the Socialist Republic of Viet Nam.

All the works method statements submitted by the Contractors to the ES for approval shall also be sent to the EO to review whether sufficient environmental protection and pollution control measures have been included.

The ES shall also review the progress and program of the works to ensure that relevant environmental laws have not been violated, and that any potential for violating the laws can be prevented.

The Contractors shall copy relevant documents to the EO and the ES. The documents shall at least include updated work progress reports, updated work measures, and application letters for different license/ permits under the environmental protection laws, and all valid license/ permits. The EO and the ES shall also have access, upon request, to the Site Log-Books.

After reviewing the documents, the EO or the ES shall advise and the Contractors of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the EO or the ES concludes that the status on license/ permit application and any environmental protection and pollution control preparation works may not comply with the work measures or may result in potential violation of environmental protection and pollution control requirements, they shall advise the Contractor accordingly.

6.5.4.6. Environmental Claims and Penalty System

In the compliance framework, if non-compliance with environmental regulations are discovered by the CSC/ ES during site supervision, 2% of interim payment value of the contractors of the

month will be held back. The Contractors will be given a grace period (determined by the CSC/ ES) to repair violation. If the Contractors perform the repairs within the grace period (confirmed by the CSC/ ES), no penalty is incurred and the retained amount will be paid. However, if the Contractors fail to successfully make necessary repairs within the grace period, the Contractors will pay a third party to repair the damages (deduction from the retained amount).

In case that the CSC/ES do not detect non-compliance with environmental regulations of the Contractors, they will be responsible for payment to repair the violation.

6.6. CAPACITY BUILDING FOR THE PMU

6.6.1.Capacity Building Activities

The Project Management Unit of the Coastal Cities Sustainable Environment Project (CCSEP) –Dong Hoi City Sub-project experienced on environmental and social management through seven years of CCESP implementation, 2007-2014. Through CCESP, the PMU leaders and staff have been familiar with the World Bank's environmental and social management requirements, related procedures, the roles and responsibilities of stakeholders in ESMP implementation and monitoring. Through discussions with the Independent Monitoring Consultants during their visits, reviewing IMC reports, discussions and advices given by the Bank CCSEP supervision missions, environmental monitoring and supervision skills of the PMU were have been built up not only for PMU Environmental Officer but also its leaders and engineers who used to very actively accompanied the Bank's Task Team Environmental Specialists during field work. PMU has ownership during ESIA preparation, be well-awared about the content, particularly mitigation commitments stated in the ESIA.

During CCSEP preparation and implementation, the PMU have assigned qualified staff to be responsible for environmental and social aspects of the project as detailed below:

No.	Name	Education	Qualification, Experiences, and Attended projects	Training
1	Hoang Van Duong	Construction Engineer	Being responsible for environment and resettlement aspects of the Environmental Sanitation Project – Dong Hoi city sub-project (phase 1);	- Social safeguard policies organized by the WB in Can Tho - Social safeguard policies organized by the ADB Da Nang
2	Dao Ngoc Phuong	Environment Engineer	Participating in conducting surveys and preparing the Resettlement Policy Framework, Environmental Impact Assessment Report, and Resettlement Plan for the "Urban Environment and Climate Change Adaptation Project" financed by the ADB for Dong Hoi city – Quang Binh province and Hoi An – Quang Nam province	- Workshop on Social Safeguard Policies organized by the ADB in Da Nang; - Various workshops, seminars, and training courses on Gender and Climate Change organized by the ADB

2	Nguyen Quang Hoa	Environment Engineer	Participating in field survey, quality control for the preparation of CCSEP ESIA	On-the-job trainnig during ESIA preparation Management of WWTP operations

During CCSEP implementation, environmental management capacity of the PMU will be further strengthened with technical assistance provided to the CSC team, particularly the CS, and training and advice provided by the IEMC.

The CSC will assist the PMU in reviewing environmental aspects in engineering design, bidding documents, construction contracts, adequacy of mitigation measures implemented during the construction phase, risks and corrective measures as well as responses in emergency to ensure compliance with ESMP.

On-site training about observation technique to recognize environmental issues at the construction sites and procedures to response to emergencies will be provided by the IEMC.

Relevant PMU staff, including technicians and site engineers, will have opportunities to attend training provided by the IEMC, including training on HIV/AIDS which have not been provided under the CCSEP.

Therefore, through CCSEP implementation, with assistance from the CSC, IEMC, field works, environmental management capacity of PMU will be strengthened and further developed.

6.6.2. Proposed Training Programs

Below provides basic safeguard training programs during project implementation. The training programs will be developed and delivered to the PMU and CSC by the IEMC.

The PMU and/or CSC, with assistance of the IEMC, will provide training to the contractors and other groups.

Training schedules: within one month since IEMC contract signing.

Table 6.10: Training Programs for Capacity Building

Training level	Trainee	Topic	Trainer	Timing
Level 1	PMU Environmental and social staff and technical staff, CSC, the DONRE	- General environmental and social management requirements in WB-financed project - Environmental management procedures (including mitigation and monitoring) with focus on design, bidding documents and contracts	IEMC	01 month since IEMC contract signing The follow-up training will be scheduled as needed.
Level 2	PMU Environmental and social staff and technical staff, CSC, representatives of contractors and communities	- Site environmental supervision: impacts, mitigation measures - Forms used in environmental and social monitoring. - Risk response and control. - Reporting and submission forms. - Grievance Redress Mechanism	IEMC	6 months since contract signing
Level 3	CSC; on-site construction management staff; environmental staff of contractors.	- Overview of environmental monitoring. - Environmental and social monitoring requirements. - Role and responsibilities of contractors and CSC.	IEMC	One-day training, twice per year, and to be repeated on a yearly basis

		- Content and methods of environmental and social monitoring. - Response and risk control. - Propagate monitoring forms and guide how to fill in the forms and risk reports. - Preparation and submission of reports.		
Level 4	Community and/ or worker, leaders.	- Preliminary presentation on socioenvironmental protection and environmental overview; - Key issues that require attention of communities and workers to minimize safety risks (roads, waterways, equipment, machines, etc.) as well as reduce pollution (dust, fume gases, oil/grease spill, waste management, etc.) and management of potential social impacts and risks; - Management of environmental safety and sanitation at sites and workers' camps; - Mitigation measures at construction sites and workers' camps; - Safety measures on electricity, mechanical, transportation, air pollution; - Other areas to be determined; - Emergency procedures; - Awareness of HIV/AIDS and infectious diseases. Train workers on issues related to environment, safety and health, thus enhancing their awareness of HIV/AIDS and infectious diseases.	IEMC	01 month since construction package signing (The number of training courses will be correspondent with the number of construction packages)

6.7. ESTIMATED ESMP COST

6.7.1. Cost for Environmental Monitoring Program

The total cost for the EMP is summarized in the following table:

Training workers on issues related to environment, safety and health, thus enhancing their awareness of HIV/AIDS and infectious diseases within two weeks prior to commencement of the packages including construction works and lasting at least six months.

Table 6.11: CEMP Estimated Cost

Parameter	Unit VND 1,000	Pre-construction phase		Construction phase (expected within 3 years)		Operation phase		Total samples	Total VND
		No. of time	Place	No. of time	Place	No. of time	Place		
I. Wastewater quality monitoring									**138,312,000**
pH	42,000	1	4	6	4	2	4	36	1,512,000
DO	60,000	1	4	6	4	2	4	36	2,160,000
TSS	124,000	1	4	6	4	2	4	36	4,464,000
COD	198,000	1	4	6	4	2	4	36	7,128,000
BOD5	199,000	1	4	6	4	2	4	36	7,164,000
NH4+	166,000	1	4	6	4	2	4	36	5,976,000
Total N	264,000	1	4	6	4	2	4	36	9,504,000

Total Phosphor	272,000	1	4	6	4	2	4	36	9,792,000
Zn	278,000	1	4	6	4	2	4	36	10,008,000
Pb	317,000	1	4	6	4	2	4	36	11,412,000
Hg	445,000	1	4	6	4	2	4	36	16,020,000
As	445,000	1	4	6	4	2	4	36	16,020,000
Grease, oil	614,000	1	4	6	4	2	4	36	22,104,000
Coliform	418,000	1	4	6	4	2	4	36	15,048,000
II, Surface water monitoring									**84,852,000**
pH	42,000	1	4	6	4	2	4	36	1,512,000
DO	60,000	1	4	6	4	2	4	36	2,160,000
TSS	124,000	1	4	6	4	2	4	36	4,464,000
COD	198,000	1	4	6	4	2	4	36	7,128,000
BOD5	199,000	1	4	6	4	2	4	36	7,164,000
NH4+	166,000	1	4	6	4	2	4	36	5,976,000
Total N	264,000	1	4	6	4	2	4	36	9,504,000
Total Phosphor	272,000	1	4	6	4	2	4	36	9,792,000
Grease, oil	614,000	1	4	6	4	2	4	36	22,104,000
Coliform	418,000	1	4	6	4	2	4	36	15,048,000
III, Air quality monitoring									**102,834,000**
Dust	111,000	1	3	6	3	1	3	24	2,664,000
Noises	119,000	1	3	6	3	1	3	90	10,710,000
CO	308,000	1	3	6	3	1	3	90	27,720,000
SO_2	371,000	1	3	6	3	1	3	90	33,390,000
NO_x	315,000	1	3	6	3	1	3	90	28,350,000
IV Sludge and mud quality monitoring									**58,023,000**
Zn	278,000	1	3	6	3	2	3	27	7,506,000
Pb	317,000	1	3	6	3	2	3	27	8,559,000
Hg	445,000	1	3	6	3	2	3	27	12,015,000
As	445,000	1	3	6	3	2	3	27	12,015,000
Grease, oil	614,000	1	3	6	3	2	3	27	16,578,000
Salinity	50000	1	3	6	3	2	3	27	1,350,000
Zn	278,000	1	3	6	3	2	3	27	7,506,000
Pb	317,000	1	3	6	3	2	3	27	8,559,000
V, Ecosystem monitoring									
Aquatic samples	30,000,000	1	2			2	2	6	**180,000,000**
VI, Monitoring report									**210,000,000**
Periodical monitoring report	12,000,000							15	180,000,000
Synthesis monitoring report	30,000,000							1	30,000,000
Total estimated cost for the Environmental Monitoring									**774,021,000**

Total cost estimated for EMP implementation is VND 774,021,000, excluding the cost for wastewater quality monitoring because when the WWTP operates, there will be a separate periodical monitoring program as requested by the environment management unit of Dong Hoi City.

6.7.2. Cost for Community Monitoring System

According to regulations of Vietnam, participation in community monitoring system will be primarily voluntary without any funding assistance. The Community Monitoring Committee will receive assistance from the PMU through capacity building programs and will be provided

with necessary documents, papers and forms to facilitate site supervision activities. However, practical experiences show that it is difficult to maintain monitoring activities in a long time with high intensity. To increase effectiveness, the community monitoring team should be provided with a certain allowance rate for their performance. The cost estimate for maintenance and operation of community monitoring system is presented below:

Table 6.12: Estimated Cost for the CEMP Implementation

Expected time	Number of supervisors	Number of Community / village staff	Allowance rate / month	Cost (VND)
Within 18 months	8 communes	5	200,000	240,000,000

6.7.3. Cost of Training

The cost estimate for training is presented below:

Table 6.13: Estimated Cost for training

Training level	No. of courses	Trainees	Cost (VND)
Level 1	1	30	40,000,000
Level 2	1	30	40,000,000
Level 3	1	40	50,000,000
Level 4	8	30-50	240,000,000
			370,000,000

6.7.4. ESMP Total Cost Estimation

The total cost for ESMP is presented in presented below:

Table 6.14: Total Cost for ESMP Implementation

Items	Cost (VNĐ)
1.Compensation	71,890,881,456
2. Mine clearance	9,747,000,000
3.Cost for implementation of mitigation measures, including reconstruction and reinstatement costs)	Included in Contract package value
4.Monitoring	
Environmental quality monitoring program (the CSC)	774,021,000
Daily environmental compliance monitoring by the CSC	450,000,000
Community monitoring system operation (community)	240,000,000
Environmental compliance monitoring (by the IEMC)	200,000,000
5.Training	
HIV/AIDs training (Included in IEMC contract)	370,000,000
Environmental training (document predation, stationery, rental of training venues, etc. included in IEMC contract)	
6.Cost for plastic tarpauline for disposal cells at Cau Cup landfill	80,000,000
Total (excluding the cost for mitigation measures implemented during construction phase by the Contractor)	

6.8. GRIEVANCE REDRESS MECHANISM (GRM)

Complaints relating to any subproject's problems will be solved through negotiations to achieve the consensus. A complaint will go through three stages before it can be transferred to the court. The enforcement unit will pay all administrative and legal fees relating to the acceptance of complaints. This cost is included in the project budget.

Complaint procedures and resolution will be performed as follows:

The first level *People's Committee of ward / commune*. An affected household is to take his/her complaint to any member of the People's Committee of the ward / commune, through the village head or directly to People's Committee of the commune / ward, in written or oral form. The said member(s) of the People's Committee or the village head will inform the People's Committee of the ward/commune on the complaint. The People's Committee of Ward/Commune will work directly in person with the said affected household and will decide on the settlement of the complaint 5 days after receiving such complaint (this may take 15 days in mountainous or remote areas). The Secretariat of the People's Committee of the relevant commune/ward is responsible for documenting and recording all the complaints that it is handling.

After the Ward/Commune People's Committee issues its decision, the relevant household can make an appeal within 30 days. In case a second decision has been issued but the said household is still not satisfied with such decision, such household can appeal to the municipal (city) People's Committee (CPC).

The second level *The CPC*. Upon receiving a complaint from a household, the CPC will have 15 days (or 30 days in case of remote and mountainous areas) after receiving the complaint to resolve the case. The CPC is responsible for filing and storing documents on all complaints that it handles.

When the CPC has issued a decision, the household can make an appeal within 30 days. In case a second decision has been issued and the household is still not satisfied with such a decision, they can appeal to the Provincial People's Committee (PPC).

The third level *The PPC*. Upon receiving a complaint from the household, the PPC will have 30 days (or 45 days in case of remote and mountainous areas) after receiving the complaint to resolve the case. The PPC is responsible for filing and storing documents for all complaints to be submitted.

After the PPC has issued a decision, the household can appeal within 45 days. In case a second decision has been issued and the household is still not satisfied with such decision, they can appeal to the court within 45 days. The PPC will then have to pay the compensation into an account.

The Forth level*Provincial Court*. In case a complainant brings his/her case to a provincial court and the court rules in favor of the complainant, the provincial authorities will have to increase the compensation up to such a rate as may be ruled by the court. In case the court's ruling is in favor of the PPC, the complainant will be refunded the amount of money that has been paid to the court.

Within the Vietnamese legal framework, citizen rights to complain are protected. As part of overall implementation of the project, a grievance redress mechanism (GRM) will be developed by the ESU of the PPMU, according procedures, responsible persons and contact information will be developed. It will be readily accessible to ensure that grievances shall be handled and resolved at the lowest level as quickly as possible. The mechanism will provide a framework within which complaints about environmental and safety issues can be handled, grievances can be addressed and disputes can be settled promptly. The GRM will be in place before construction commencement.

During construction, the GRM will be managed by the contractors under supervision of the CSC. The contractors will inform the affected communities and communes about the GRM availability to handle complaints and concerns about the project. This will be done via the community consultation and information disclosure process under which the contractors will

communicate with the affected communities and interested authorities on a regular basis. Meetings will be held at least quarterly, monthly information brochures will be published, announcements will be placed in local media, and notices of upcoming planned activities will be posted, etc.

All complaints and corresponding actions undertaken by the contractors will be recorded in project safeguard monitoring reports. Complaints and claims for damages could be lodged as follows:

- Verbally: direct to the CSC and/ or the contractors' safeguard staff or representatives at the site offices.
- In writing: by hand-delivering or posting a written complaint to specified addresses.
- By telephone, fax, e-mails: to the CSC, the contractors' safeguard staff or representatives.

Upon receipt of a complaint, the CSC, the contractors' safeguard staff or representatives will register the complaint in a complaint file and maintain a log of events pertaining to it thereafter, until it is resolved. Immediately after receipt, four copies of the complaint will be prepared. The original will be kept in the file, one copy will be used by the contractor's safeguard staff, one copy will be forwarded to the CSC, and the fourth copy to the PPMU within 24 hours since receipt of the complaint.

Information to be recorded in the complaint log will consist of:

- The date and time of the complaint.
- The name, address and contact details of the complainant.
- A short description of the complaint.
- Actions taken to address the complaint, including contact persons and findings at each step in the complaint redress process.
- The dates and times when the complainant is contacted during the redress process.
- The final resolution of the complaint.
- The date, time and manner in which the complainant was informed thereof.
- The complainant's signature when resolution has been obtained.

Minor complaints will be dealt with within one week. Within two weeks (and weekly thereafter), a written reply will be delivered to the complainant (by hand, post, fax, e-mails) indicating the procedures taken and progress to date.

The main objective will be to resolve an issue as quickly as possible by the simplest means, involving as few people as possible, and at the lowest possible level. Only when an issue cannot be resolved at the simplest level and/ or within 15 days, will other authorities be involved. Such a situation may arise, for example, when damages are claimed, the to-be-paid amount cannot be resolved, or damage causes are determined.

The World Bank's Grievance Redress Mechanism: Communities and individuals who believe that they are adversely affected by a WB-financed project may submit complaints to the available project-level grievance redress mechanism or the WB's Grievance Redress Service (GRS). The GRS will ensure that complaints received are promptly reviewed to adddress project-related concerns. The affected communities and individuals of the project may submit their complaints to the WB's independent Inspection Panel that will determine whether harms occurred, or can occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at anytime after concerns have been brought directly to the WB's attention, and the Bank Management has been given an opportunity to respond. For information

on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit www.worldbank.org/grs. For information on how to submit complaints to the World Bank Inspecition Panel, please visit www.inspectionpanel.org.

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CHAPTER 7. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

7.1. SUMMARY OF PUBLIC CONSULTATION

In the ESIA process, information disclosure and public consultation on environment ensures the acceptance of local authorities, local NGOs and local affected people in the sub-project areas. Through public consultation, unidentified environmental adverse impacts and mitigation measures can be recognized and included in ESIA report.

7.1.1. Consultation with the People's Committees of Affected Wards and Communes

The ESIA Consultant collaborated with the sub-project Employer to consult local authorities via meetings at ward/ commune-level PCs after sending consultation documents to the affected wards and communes (see the attached annex of this report).

Public consultation was organized at 11 affected wards in Dong Hoi city. Consultation contents, time, and venues are consolidated in following Table 7.1:

Table 7.11: Public Consultation Results – 1st session

Date	Venue	No. of participants	Information provided	Comments of local people	The PMU's responses
10/5/2016	Office of Bac Nghia ward PC	4	- Detailed information on each works item at the wards/ communes. - Overall map and details of the project works. - The draft ESIA report - The WB safeguard policies on environment and resettlement	- Compensation and site clearance must be completed prior to construction commencement; - Compensation prices must reflect market prices; - Allowances and support should be provided to HHs whose productive land is acquired and livelihoods are affected to allow them to change their livelihoods; - In addition, contractors must implement sufficient environmental protection measures throughout the construction phase to avoid negative impacts on health and daily life of the people, roads, business operation of HHs living adjacent to construction sites of roads, bridges, PSs, drains and sewers. - Recruiting local people as workers during project implementation.	- Site clearance and compensation will be carried out in compliance with the GOV regulations and the WB policies; - Support will be provided to local people for livelihood transition; - Proper jobs will be provided to local people during the project implementation; - Environmental protection measures will be carried out as committed in the ESIA;
11/5/2016	Office of Dong Son ward PC	3			
11/5/2016	Office of Nam Ly ward PC	3			
12/5/2016	Office of Duc Ninh Dong ward PC	4			
12/5/2016	Office of Dong My ward PC	3			
13/5/2016	Office of Bac Ly ward PC	7			
13/5/2016	Office of Phu Hai ward PC	8			
16/5/2016	Office of Hai Thanh ward PC	8			
16/5/2016	Office of Duc Ninh ward PC	6			
17/5/2016	Office of Dong Phu ward PC	5			
17/5/2016	Office of Hai Dinh ward PC	3			

7.1.2. Consultation with Communities that Are Directly Affected

Public consultation was implemented as below: the ESIA Consultant co-operated with the

project Employer/ the commune-level PCs to consult leaders and affected HHs (upon availability of a The draft ESIA report). During the consultation process, the ESIA Consultant informed about potential negative impacts during project implementation and proposed mitigation measures for such impacts. Affected HHs commented on the presented environmental issues and proposed mitigation measures.

The second consultation session (time, venues, participants, and contents), together with the results, is summarized in following table:

Table 7.12: Consultation results – 2nd session

Commune/ Ward	Time/ Venue	Participants	No. of participants	Information provided	Comments of local people	The PMU's responses
Duc Ninh Dong	Office of Duc Ninh Dong Ward PC 23/6/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative - HHs in the project areas	**20**	- Detailed information on each works item at the ward/ commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	- The local people strongly support the project - The project will bring about positive impacts and improve environmental sanitation for local people - Compensation plans should be reasonable and satisfactory for people whose land is acquired by the project. - Priority should be given to recruitment of local people for project implementation. - Mitigation measures must be implemented during the construction phase. - The HHs who loses their livelihoods wish to receive support for livelihood changes and be recruited for the project operation phase.	- Comments of the local people will be incorporate in the ESIA report to increase the project benefits and mitigate negative impacts to people's lives. - Compensation: the WB pay special attention to people's lives and social welfare, hence, the most suitable policy framework has been developed. - The PMU agree with comments of the local people.
Phu Hai	Office of Phu Hai Ward PC 23/6/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative - HHs in the project areas	**30**	- Detailed information on each works item at the ward/commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	- The Employer must commit to the local authority and people that they will complete site clearance and compensation before construction commencement, and compensation prices must be close to market prices. - Priority should be given to recruitment of local people for project implementation. - Mitigation measures must be implemented during the construction phase. - The HHs who lose their livelihoods wish to receive support for livelihood changes and be recruited for the project operation phase. - Landscape at the Cemetery should be improved for a better aesthetic view of the whole area	- Compensation and site clearance will be carried out strictly as per requirements of the WB and Quang Binh PPC. - The PMU acknowledge the comments and will revise the report with inclusion of these comments. - Local workers will be prioritized during construction and operation phases of the project.
Duc Ninh	Office of Duc Ninh	- The PMU's representative - Representative	**30**	- Detailed information on each works item at the ward/commune.	- Contractors must comply with environmental commitments stated by the Employer in the ESIA report. If the contractors fail to meet these	- The Employer will amend and provide additional mitigation measures that are

	Commune PC 24/6/2016	of the local authority - The Consultant's representative - HHs in the project areas		- Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	requirements, the Employer shall replace them with other contractors immediately; - Affected works by the project construction activities must be reinstated. - Compensation prices should be as market prices. - Livelihood transition support should be provided to people whose agricultural land is acquired.	appropriate with local conditions; - Compensation and site clearance will be carried out strictly as per requirements of the WB and the GOV; - Livelihood transition support will be provided for local people; - Proper jobs will be provided for local workers throughout the project implementation; - All environmental protection measures will be carried out as committed in the ESIA report;
Bac Ly	Office of Bac Ly Ward PC 24/6/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative - HHs in the project areas	**35**	- Detailed information on each works item at the ward/commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	- Site clearance and compensation must be completed before construction commencement; - Affected works by the project construction activities must be reinstated; - Compensation prices should be as market prices; - Workers should be managed properly to avoid conflicts with local people and social evils.	- The Employer will amend and provide additional mitigation measures that are appropriate with local conditions; - Compensation and site clearance will be carried out strictly as per requirements of the WB and the GOV; - Livelihood transition support will be provided for local people; - Proper jobs will be provided for local workers throughout the project implementation; - All environmental protection measures will be carried out as committed in the ESIA report;

Dong Phu	Office of Dong Phu Ward PC 25/6/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative - HHs in the project areas	**27**	- Detailed information on each works item at the ward/commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	- Site clearance and compensation must be completed before construction commencement; - Affected works by the project construction activities must be reinstated; - Compensation prices should be as market prices; - Local people and members of HHs whose land is acquired permanently by the project should be recruited as workers during the project construction and operation phases.	- The Employer will amend and provide additional mitigation measures that are appropriate with local conditions; - Compensation and site clearance will be carried out strictly as per requirements of the WB and the GOV; - All environmental protection measures will be carried out as committed in the ESIA report;
Hai Thanh	Office of Hai Thanh Ward PC 25/6/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative - HHs in the project areas	**15**	- Detailed information on each works item at the ward/commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	- Detailed construction schedules for drains and PSs must be provided to local people. - Damages to existing facilities such as electricity lines, sidewalks, trees, etc. must be limited; - Disturbance to business and tourism operation of HHs at road fronts should be minimized; - Priority should be given to recruitment of local people; - Existing facilities must be reinstated in case of any damages	- The Employer will amend and provide additional mitigation measures that are appropriate with local conditions; - All environmental protection measures will be carried out as committed in the ESIA report;
Hai Dinh	Office of Hai Dinh Ward PC 26/6/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative	**13**	- Detailed information on each works item at the ward/commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition	- Detailed construction schedules for drains and PSs must be provided to local people. - Damages to existing facilities such as electricity lines, sidewalks, trees, etc. must be limited; - HHs wish to connect to the sewerage system of the project. - Priority should be given to recruitment of local people;	- All environmental protection measures will be carried out as committed in the ESIA report; - Project information and construction schedules will be disclosed in an open manner; - Priority will be given to recruitment of local people;

		- HHs in the project areas		- The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement		
Dong My	Office of Dong My Ward PC 26/6/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative - HHs in the project areas	**20**	- Detailed information on each works item at the ward/commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	- Detailed construction schedules for drains and PSs must be provided to local people. - Damages to existing facilities such as electricity lines, sidewalks, trees, etc. must be limited; - Existing facilities must be reinstated in case of any damages.	- All environmental protection measures will be carried out as committed in the ESIA report; - Project information and construction schedules will be disclosed in an open manner; - Priority will be given to recruitment of local people;
Nam Ly	Office of Nam Ly Ward PC 27/6/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative - HHs in the project areas	**15**	- Detailed information on each works item at the ward/commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	- Detailed construction schedules for drains and PSs must be provided to local people. - Damages to existing facilities such as electricity lines, sidewalks, trees, etc. must be limited; - Priority should be given to recruitment of local people; - Existing facilities must be reinstated in case of any damages.	- All environmental protection measures will be carried out as committed in the ESIA report; - Project information and construction schedules will be disclosed in an open manner; - Priority will be given to recruitment of local people;

Bac Nghia	Office of Bac Nghia Ward PC 27/6/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative - HHs in the project areas	**10**	- Detailed information on each works item at the ward/commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	- Detailed construction schedules for drains must be provided to local people. - Damages to existing facilities such as electricity lines, sidewalks, trees, etc. must be limited; - Priority should be given to recruitment of local people;	- All environmental protection measures will be carried out as committed in the ESIA report; - Project information and construction schedules will be disclosed in an open manner; - Priority will be given to recruitment of local people;
Dong Son	Office of Dong Son Ward PC 276/2016	- The PMU's representative - Representative of the local authority - The Consultant's representative - HHs in the project areas	**16**	- Detailed information on each works item at the ward/commune. - Overall map, and details of the project works. - Detailed information about HHs affected by land acquisition - The draft ESIA report - Forms for collection of people's comments - The WB safeguard policies on environment and resettlement	- Detailed construction schedules for drains and PSs must be provided to local people. - Damages to existing facilities such as electricity lines, sidewalks, trees, etc. should be limited; - Priority should be given to recruitment of local people; - Existing facilities must be reinstated in case of any damages.	- All environmental protection measures will be carried out as committed in the ESIA report; - Project information and construction schedules will be disclosed in an open manner; - Priority will be given to recruitment of local people;

7.2. RESULTS OF PUBLIC CONSULTATION

7.2.1. Comments of Affected Ward PCs

Comments of the PCs and the Fatherland Fronts of the wards affected directly the project are consolidated as below:

- The Employer is requested to implement properly all mitigation measures to limit negative impacts of the project on the natural environment, and the local social – economic environment;
- The Employer is requested to implement strictly the environmental monitoring program approved for the project;
- Construction methods must be adequate and appropriate;
- + No disturbance to traffic, no air pollution, occupational safety and social security must be ensured during the construction time, and affected facilities must be reinstated to their original status.
- + Facilities of local people will not be affected during the construction phase, and construction process should be optimized to provide the fastest construction speed, especially there should be no obstruction to operation of business HHs within the project sites.
- + Upon construction completion, the sites will be reinstated to their original conditions, and infrastructure used temporarily for construction purpose should be recovered.
- The Employer is requested to use local workforce for project implementation to create jobs for the people;
- The Employer is required to comply with general Vietnam national standards on environmental protection and particular standards of Quang Binh province.

7.2.2. Comments of Affected Communities

The ESIA Consultant conducted public consultation with affected HHs in the project areas. Most of the affected people support the project and they all show common concerns and requests as follows:

- The Employer must complete site clearance and compensation prior to construction commencement.
- HHs who lose their productive land and livelihoods needs livelihood transition support to maintain their lives.
- Besides, construction contractors must implement adequate environmental protection measures throughout the construction phase to avoid negative impacts on health and daily activities of people, roads and business operation of HHs at the road fronts within construction areas of roads, PSs, and drains.

7.2.3. The Employer's Responses and Commitments

- The Employer will implement properly the project resettlement action plan approved by the GOV and the WB;
- The project will provide livelihood transition support for HHs who lose their productive land and livelihoods so that they can stabilize their lives;

- The Employer shall plan construction schedules appropriately to avoid disturbance to daily activities of local people and to ensure social security;
- To ensure quality of the environment, water, air, and noise control, etc., the Employer shall request contractors to follow strictly the Law on environmental protection, Vietnam national regulations and standards on environment and shall monitor closely such compliance, and timely actions will be made in cases of violation resulting in negative impacts on soil, air, and water quality, etc.;
- The Employer commits to implement the mitigation measures presented in Chapter 4 of this report;
- For preparation of the project ESIA report, the Employer have sent official consultation requests to all PCs of affected communes and wards, together with one (01) The draft ESIA report in which impacts and mitigation measures are described, for community review and comments. According to officially written responses, all PCs fully support the project and recommend early project implementation. Hence, absolute agreement has been given to the project by both local people and local authorities. The Employer sincerely look forward to needful cooperation to implement the project soon;
- Comments of the PCs and local people of affected communes and wards have been considered and included in the revised ESIA report. Requested actions have also been committed in Chapters 4, 5, and 6 of this report;
- The Employer undertakes that local workers will be recruited during the project implementation.

7.3. INFORMATION DISCLOSURE

The draft ESIA report will be disclosed at the People Committee's office of Dong Hoi city and PCs' offices of the affected wards and communes on 5 October 2016. Information about such disclosure will be posted in the website of Dong Hoi CPC. After reviewing the draft ESIA, local people can provide their comments and inputs on environmental issues of the project.

The final version of this ESIA report will be submitted to the WB and posted in the Infoshop.

CONCLUSIONS, RECOMMENDATIONS, AND COMMITMENTS

1. CONCLUSIONS

The "*Coastal Cities Sustainable Environment Project – Dong Hoi city sub-project, Quang Binh"* will play a critical role in not only improving environmental sanitation conditions and living conditions of Dong Hoi city population but also contributing to protection of water quality in such basins as the Nhat Le river system in general and coastal areas in particular, e.g. Nhat Le Bao Ninh, all of which in return will facilitate local tourism development. The project implementation is absolutely in line with directions and policies of the Communist Party and the Government of Vietnam during the process of industrialization and modernization for sustainable development. Environmental significance of this Project is undeniable.

The ESIA report has presented impacts of each activity in all the project phases. Impacts on each subject and by each generation source have been quantified to the best extend. Proposed mitigation measures are feasible and highly efficient. However, to ensure remaining impacts at acceptable levels, environment monitoring will be carried out to provide more proper and timely corrective actions. Public consultation has been implemented as per requirements with participation of the PCs' representatives and communities of 11 affected communes and wards in the project areas.

During preparation of the ESIA report, Vietnam national technical standards and regulations and the WB's policies are complied with strictly.

2. RECOMMENDATIONS

The Employer look forward to attention and support of the project leaders, the World Bank, relevant authorities and departments of various sectors and at various levels during the project implementation, particularly during site clearance and compensation. Environmental protection actions and remedial actions for environmental incidents and risks are greatly encouraged, and close collaboration is desired for such actions. In addition, the Employer look for co-operation, comments, and inputs from relevant agencies and local communities during the project implementation.

The Employer recommend that Quang Binh PPC, the DONRE, and relating agencies and organizations should strengthen environmental management in the locality.

3. COMMITMENTS

3.1. General Commitments

The Employer commit to complying with applicable Vietnam law and regulations on environmental protection: Law on Environmental Protection 2014, and other relevant legal documents (Decree No. 18/2015/ND-CP dated 14 February 2015 by the Government on environmental protection assessment, strategic environmental assessment, environmental impact assessment and environmental protection plan; Decree No. 38/2015/ND-CP dated 24 April 2015 by the Government on management of waste and discarded materials; Decree No. 88/2007/ND-CP dated 28 May 2007 by the Government on urban drainage and urban zones, etc.), and the WB's safeguard policies during the project implementation.

The Employer commit to implement fully all mitigation measures for negative impacts of the project on the environment during the pre-construction, construction and operation phases as presented in Chapters 5 and 6 of this report.

The project activates will be under monitoring and inspection of competent authorities such as Quang Binh DONRE, Quang Binh PPC, and other relevant agencies for the project development and environmental protection.

The Employer commit to disclose the approved ESIA report for the subproject so that compliance with environmental protection commitments in the approved ESIA report can be monitored.

3.2. Commitments to Environmental Standards and Regulations

The Employer commit to comply strictly environmental standards and regulations as below:

Exhaust emission: Vietnam standard QCVN 05:2013/BTNMT- Air quality - National technical regulation on ambient air quality;

Wastewater: It is committed to provide mitigation measures and operate the wastewater treatment system properly to ensure that treated wastewater quality will meet requirements of Vietnam standard QCVN 14:2008/BTNMT (column B): National technical standards on domestic wastewater quality;

Noises: Noises will be controlled in accordance with Vietnam standard QCVN 26:2010/BTNMT on noises.

Solid wastes: Solid wastes will be collected and treated strictly to ensure that there will be no dispersion and spillage of wastes to the ambient environment that meets environmental sanitation requirements stipulated in Decree No. 59/2007/ND-CP dated 09/4/2007 by the Government on solid waste management, Decree No. 38/2015/ND-CP dated 24/04/2015 by the Government on management of wastes and discarded materials, etc.

Hazardous wastes: Circular No. 36/2015/TT-BTNMT dated 30/5/2015 by the MONRE on management of hazardous wastes will be followed.

3.3. Commitments to Environmental Pollution Control and Management

Environmental management and environmental pollution control will be prioritized throughout the construction and operation phases;

The Employer commit to co-operate with competent agencies during the project design, construction, and operation of treatment systems and environmental protection facilities;

During the operation phase, the Employer commit to implement an environmental pollution management and control at the project sites as presented in the report and periodic reports submitted to Quang Binh DONRE;

The Employer commit to provide compensation and remedial actions for environmental pollution in cases of any environmental incidents and risks incurred during the project implementation;

The Employer commit to complete the project scope of work, especially construction works and supply of environmental pollution control and treatment facilities and equipment after the ESIA report is approved.

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ANNEXES

Annex 01: Decision on approval of the ESIA report by Quang Binh PPC

Annex 02: Analysis results for aquatic samples

Annex 03: Environmental monitoring layout

Annex 04: Photos of public consultation

Minutes of public consultation

Annex 05: Detailed description of materials pits for the project

Annex 06: Due Diligence Review

Annex 07: CCSEP Dong hoi Dredging and Dredged Materials Management Plan

ANNEX 02: SAMPLE ANALYSIS RESULTS

1. Analysis Results of Aquatic Samples

+ *Species structure and compositions*

Bacillariophyceae	38 species	92.7%
Dinophyceae	3 species	7.3%
Total	41 species	100.0%

Species compositions of plankton at the sampling locations include two groups: bacillariophyceae and dinophyceae.

Bacillariophyceae consist of *Aulacoseira sp., Chaetoceros* (4 species), *Coscinodiscus subtilis, Cyclotella sp., Rhizosolenia setigera, Skeletonema costatum, Nitzschia longissima, Synedra sp., Pseudonitzschia sp., Thalassiothrix frauenfeldii* indicating that the environment is nutrition and organic polluted. Of which, *Pseudonitzschia sp.* can cause poisonous impacts on human beings and animals when its population booms.

+ *Plankton quantity*

Plankton quantity is from 12,300 to 16,200 individuals per liter, *Skeletonema costatum* that indicates an organic environment predominate in all sample locations.

Table 2.1: Plankton Species Compositions and Quantity Le Ky and Cau Rao rivers

No.	Scientific name	Sample location	
		TS1	***TS2***
	BACILLARIOPHYCEAE		
	Centrales		
1	Aulacoseira sp.	+	+
2	Chaetoceros lorenzianus	+	+
3	Chaetoceros sp.3		
4	Chaetoceros sp.1	+	
5	Chaetoceros sp.2		
6	Coscinodiscus bipartitus	+	+
7	Coscinodiscus subtilis	+	+
8	Coscinodiscus gigas	+	+
9	Coscinodiscus sp.		
10	Cyclotella sp.	+	+
11	Ditylum sol	+	+
12	Ditylum brightwellii	+	+
13	Guinardia sp.	+	
14	Hemiaulus sinensis		+
15	Leptocylindrus danicus	+	+
16	Odontella regia	+	
17	Rhizosolenia crassispina		
18	Rhizosolenia stolterfothii	+	
19	Rhizosolenia setigera	+	+
20	Skeletonema costatum	+	+
	Pennales		
21	Amphiprora alata	+	+
22	Cymbella lanceolata	+	
23	Cymbella sp.		
24	Gyrosigma sp.	+	+
25	Gyrosigma spenceri		
26	Eunotia sp.		+
27	Nitzschia longissima	+	+

No.	Scientific name	Sample location	
		TS1	***TS2***
28	Nitzschia longissima v. reversa	+	+
29	Pleurosigma angulatum	+	+
30	Pseudonitzschia sp.1	+	+
31	Pseudonitzschia sp.2		
32	Guinardia sp.		
33	Synedra sp.	+	+
34	Diploneis bombus	+	
35	Diploneis sp.		
36	Thalassiosira sp.	+	
37	Thalassionema nitzschioides	+	+
38	Thalassiothrix frauenfeldii	+	+
	DINOPHYCEAE		
	Peridiniales		
39	Ceratium furca	+	+
40	Peridinium sp.1		
41	Peridinium sp.2	+	
	Total species	**29**	**23**
	Quantity of individual per litre	**12,300**	**16,200**

❖ ***Zooplankton***

+ *Species compositions*

Copepoda	15 species	71.4%
Coelenterata	1 species	4.8%
Prochordata	1 species	4.8
Larva	4 species	19.0
Total	21 species	100.0%

Salt-water zooplankton are found in samples of the Le Ky river, including: *Eucalanus subcrassus, Labidocera minuta, Acartia clausi, Oithona (4 species), Microsetella norvegica* indicate a rich environment in terms of organic substances, etc.

+ *Zooplankton quantity*

The zooplankton quantity is from 7,100 to 18,700 individuals per cubic meter, *Nauplius* larva predominates at all sample locations.

Table 2.2: Zooplankton Species Compositions and Quantity of in Le Ky and Cau Rao rivers

No.	Scientific name	**Sample locations** (individual per m^3)	
		TS1	***TS2***
	I- COPEPODA		
	Eucalanidae		
1	Eucalanus subcrassus Giesbrecht	1	2
	Paracalanidae		
2	Paracalanus parvus (Claus)	13	7
3	Paracalanus aculeatus Giesbrecht	1	5
	Centropagidae		
4	Centropages calaninus Dana		4
	Pontellidae		
5	Labidocera minuta (Giesbrecht)	1	3
6	Calanopia thompsoni A.Scott		1
	Acartiidae		

No.	Scientific name	Sample locations (individual per m^3)	
		TS1	***TS2***
7	Acartia clausi Giesbrecht	6	3
8	Acartia erythraea Giesbrecht	2	7
9	Acartia pacifica Steuer		4
	Oithonidae		
10	Oithona plumifer Baird	3	4
11	Oithona similis (Claus)	17	47
12	Oithona brevicornis Giesbrecht		2
13	Oithona rigida Rosendorn	1	
	Ectinosomidae		
14	Microsetella norvegica (Boeck)		1
	Tachioliidae		
15	Euterpina acutifrons Dana	1	
	II- COELENTERATA		
	Thaunantitiadae		
16	Obelia sp.		
	III- PROCHORDATA		
	Appenculariidae		
17	Oikopleura longicauda Vogt		
	IV- LARVA		
18	Nauplius copepoda	24	67
19	Zoe	1	1
20	Polychaeta		5
21	Caviar		
	Quantity (individual per m^3)	8,200	12,700

❖ ***Big spineless species living at the bottom layers***

\+ *Species compositions*

Polychaeta	6 species	60%
Crustacea	4 species	40%
Total	10 species	100.0%

At this sample taking time, there are only two types of spineless species *Polychaeta and Crustacea,* of which *Diopatra neapolitana, Seoloplos armiger, Prionospio sp, Bispira polymorpha,* and *Tachea sp.* indicate that the environment is relatively organic polluted.

\+ *Quantity of big spineless species living at the bottom layers*

Numbers of big spineless species living at the bottom layers are quite similar at all sample locations, within the range from 140 to 170 individual per square meter, *Grandidierella lignorum* predominates at four locations No. 1, 2, 3, and 5. *Prionospio sp*. show that the environment at location No. 7 is organic polluted.

Table 2.3: Compositions and Quantity of Big Spineless Species

No.	Scientific name	Sample location (unit per m^2)	
		1	***2***
	PHYLUM ANNELIDA		
	CLASS POLYCHAETA		
	Order NEREIMORPHA		
	Family Nephthydidae		
1	Nephthys polybranchia (Southern)	2	1
	Family Nereidae		

No.	Scientific name	**Sample location** (unit per m^2)	
		1	***2***
2	Neanthes caudata (Delle Chiaje)		
	Order EUNICEMORPHA		
	Family Eunicidae		
3	Diopatra neapolitana (Delle Chiaje)	1	
	Order SPIOMORPHA		
	Family Arcidae		
4	Scoloplos armiger (O.F.Muller)		
	Family Spionidae		
5	Prionospio sp.	2	
	Order SERPULIMORPHA		
	Family Sabellidae		
6	Bispira polymorpha Johnson		1
	PHYLUM ARTHROPODA		
	CLASS CRUSTACEA		
	Order AMPHIPODA		
	Family Gammaridae		
7	Melita sp		2
	Family Corophiidae		
8	Grandidierella lignorum Barnard	9	11
	Order ISOPODA		
	Family Anthuridae		
9	Cyathura truncata Dang		
	Family Corallanidae		
10	Tachaea sp.	2	
	Number of species	**5**	**4**
	Quantity (individual per m2)	**160**	**150**

ANNEX 03: RELATED LAYOUTS (DRAWINGS AND MAPS)

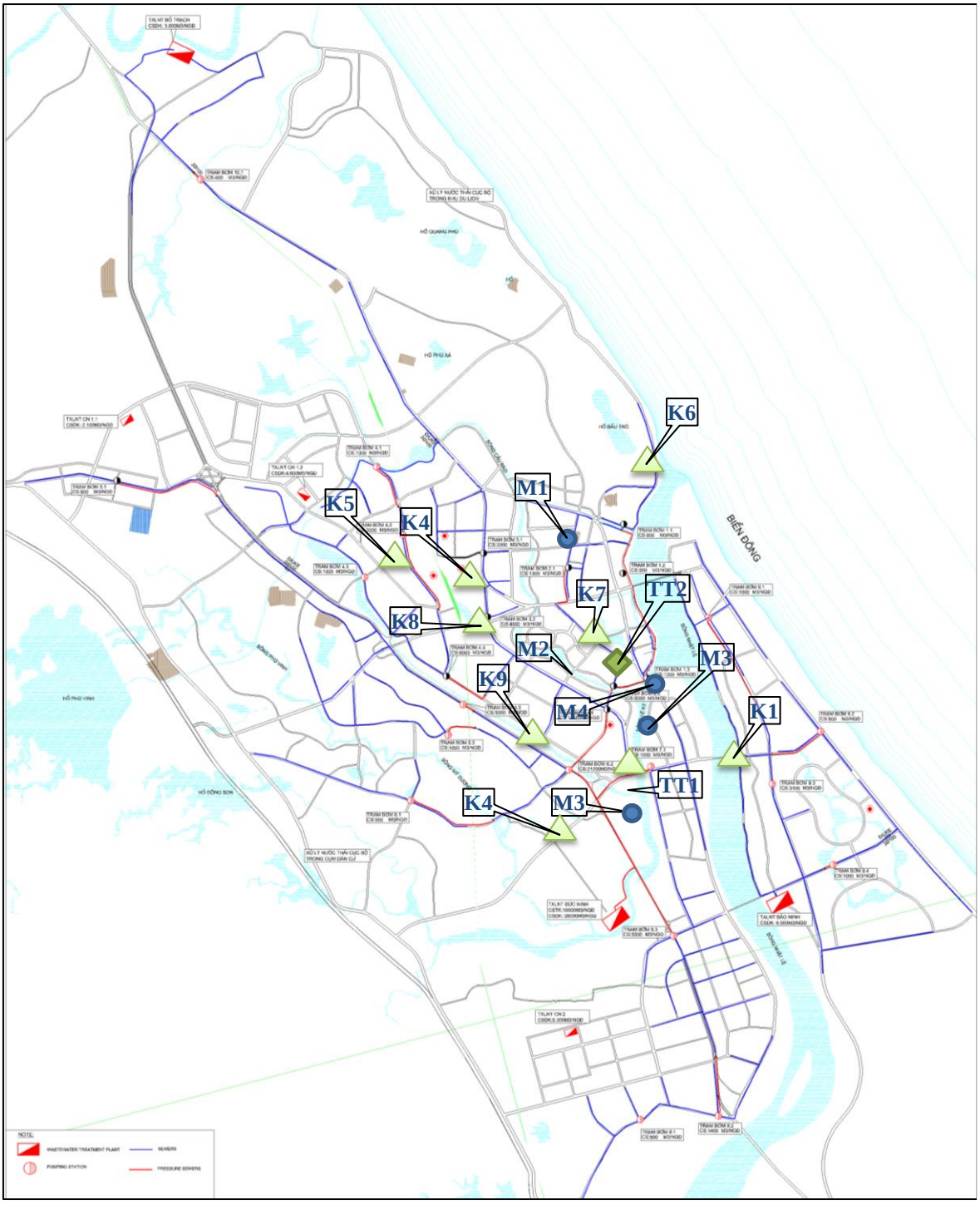
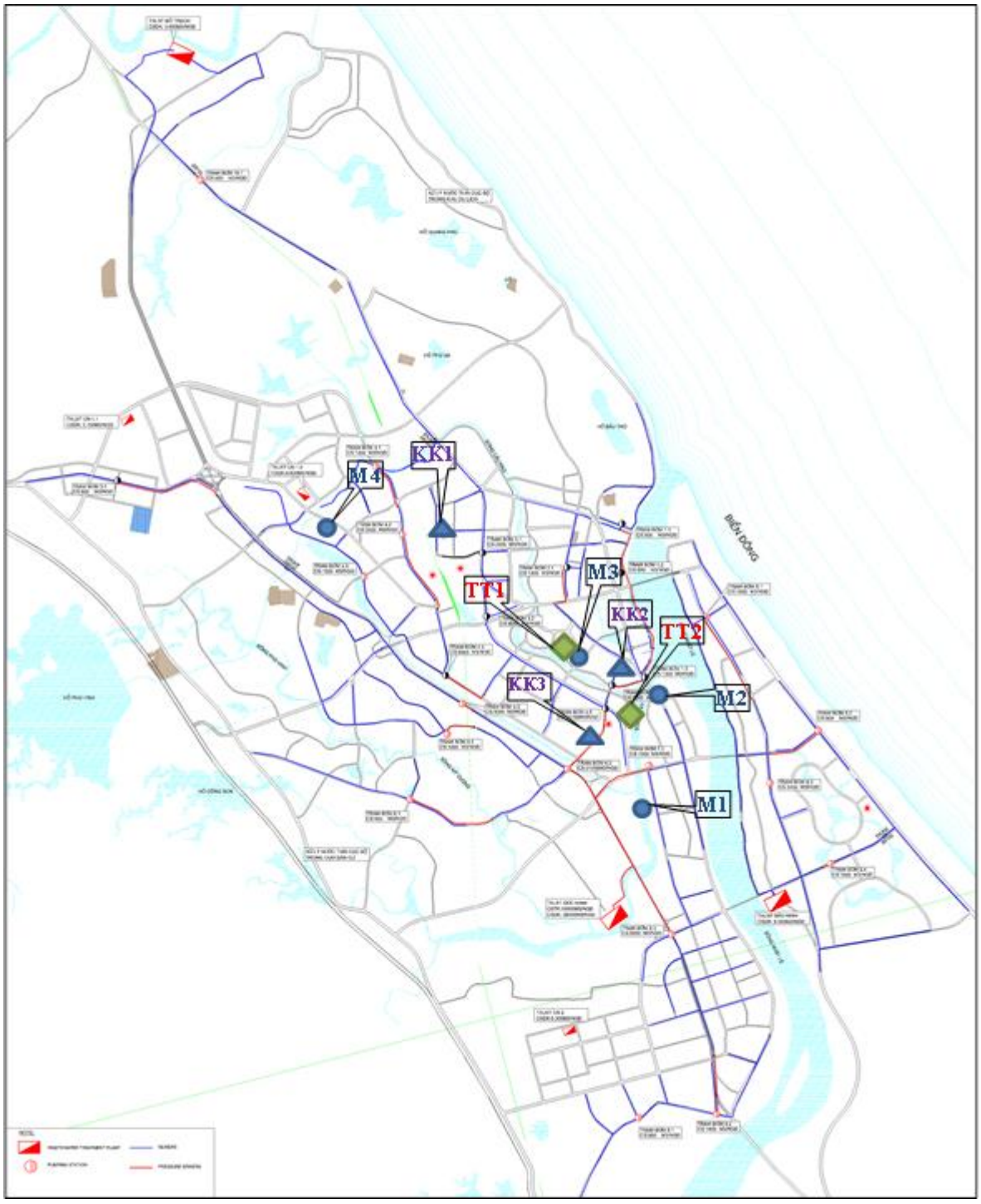


Figure 3.1: Layout of Environmental Sample Locations

Figure 3.2: Layout of Environmental Sample Locations



Symbol	Sample location
1. Locations of surface water samples	
M1	In Le Ky river, at construction site of the bridge
M2	In Cau Rao river, at the construction site of Cong Muoi bridge
M3	In Cau Rao river, at the dredging section
M4	Khe Duyen lake
2. Locations of air samples	
KK1	Drain construction sites
KK2	At one end of Cong Muoi bridge, in Le Loi road

KK3	The cross section between the construction road and the NH1
3. Locations of sediment samples	
TT1	The dredging section in Cau Rao river
TT2	The construction site of Le Ky bridge in Le Ky river
4. Locations of wastewater samples	
NT1	Wastewater from sewers
NT2	Intake wastewater of the pumping station at Duc Ninh WWTP
NT 3	Treated wastewater before discharging to Le Ky river
NT 4	Le Ky river water after the discharge point

ANNEX 03 PUBLIC CONSULTATION



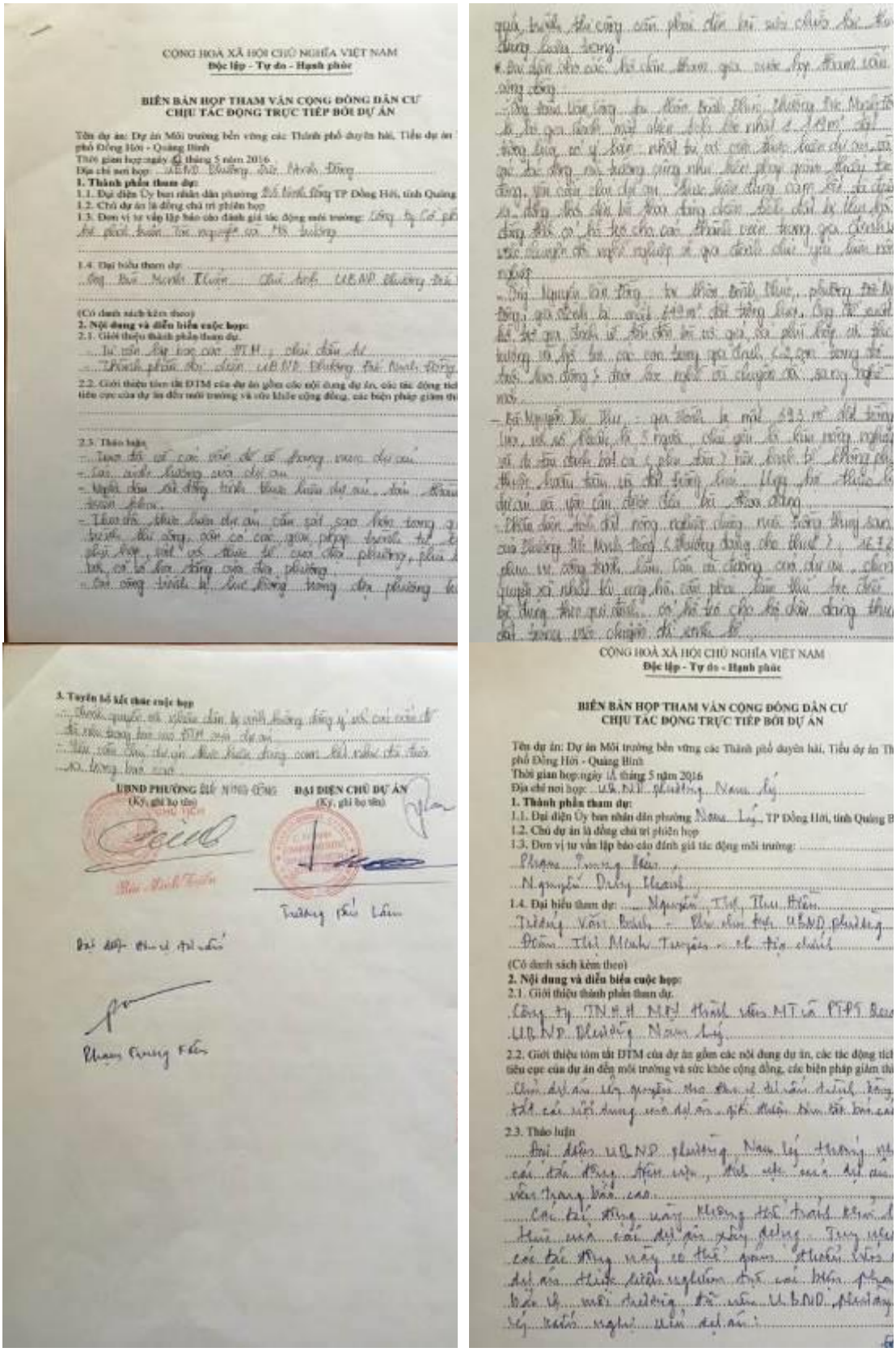



Photo 2.1: Consultation with local authorities (at the city, commune, and ward levels) and affected people



Photo 2.2: 2nd consultation meetings – with the communities affected directly by the project

Photo 2.3: Summary of consultation meeting minutes

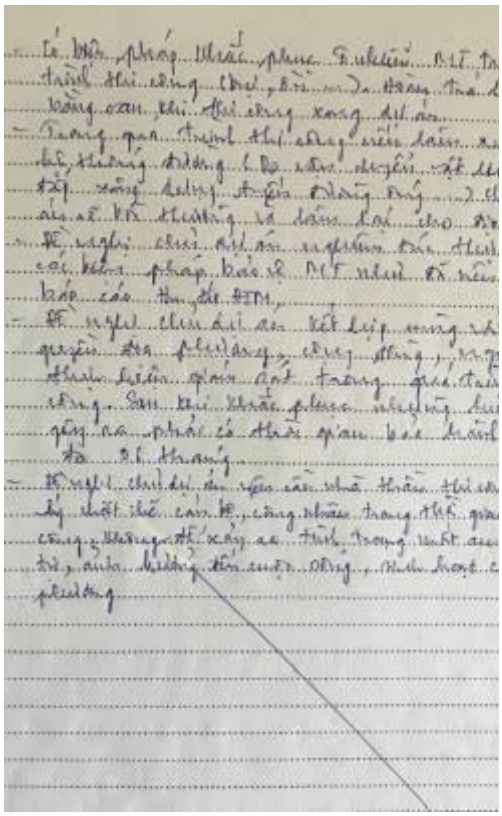


CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

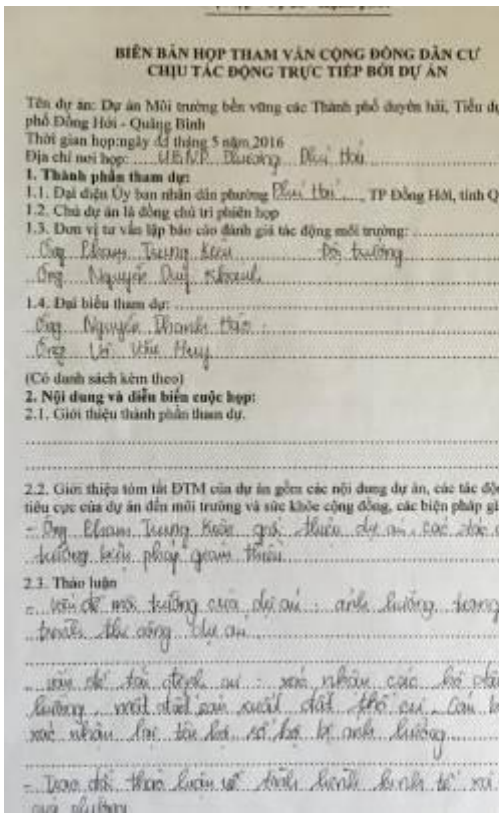
BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ
CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN

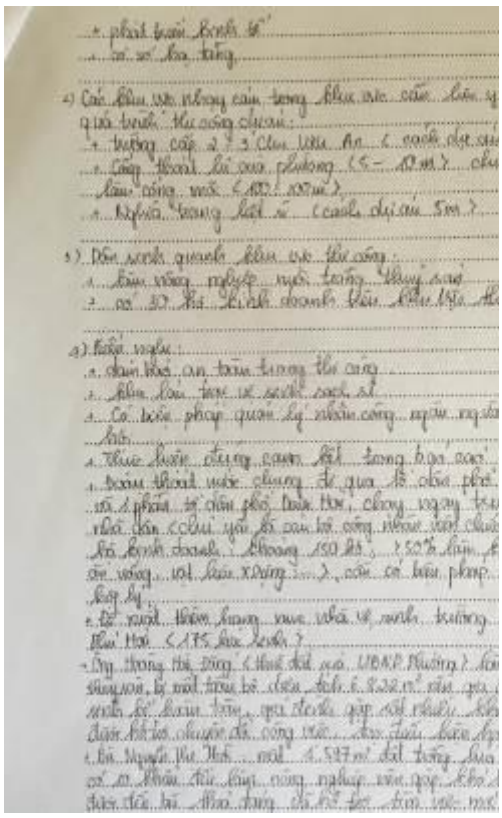
CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ
CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN




3. Tuyên bố kết thúc cuộc họp
UBND PHƯỜNG
(Ký, ghi họ tên)
PHÓ CHỦ TỊCH
Trương Văn Bình
ĐẠI DIỆN CHỦ
(Ký, ghi họ tên)
Phạm Phụng Kiên


BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ
CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN
Thời gian họp:ngày 03 tháng 5 năm 2016
1. Thành phần tham dự:
1.1. Đại diện Ủy ban nhân dân phường Bắc Nghị, TP Đồng Hới, tỉnh Q
1.2. Chủ dự án là đồng chủ trì phiên họp
1.3. Đơn vị tư vấn lập báo cáo đánh giá tác động môi trường:
Ông Nguyễn Thanh Tùng
Ông Võ Văn Huy
1.4. Đại biểu tham dự:
Ông Nguyễn Thanh Tùng
Ông Võ Văn Huy
(Có danh sách kèm theo)
2. Nội dung và diễn biến cuộc họp:
2.1. Giới thiệu thành phần tham dự.
2.3. Thảo luận



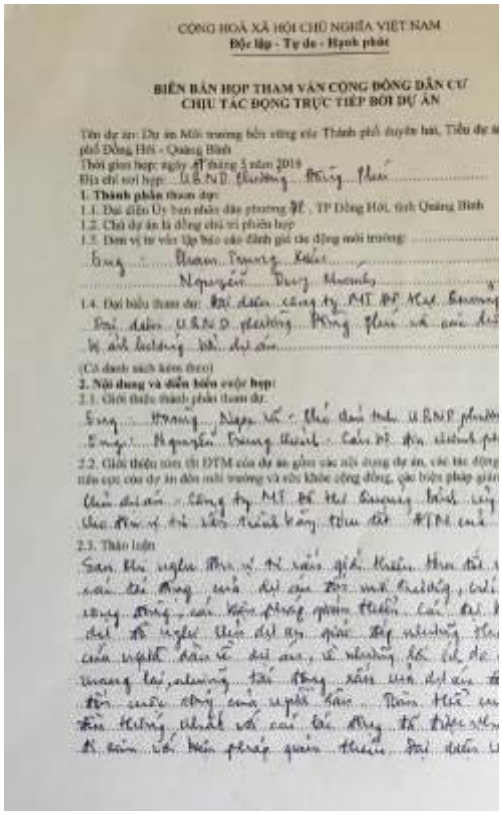
3. Tuyên bố kết thúc cuộc họp

UBND PHƯỜNG ... (Ký, ghi họ tên)

ĐẠI DIỆN CHỦ ... (Ký, ghi họ tên)

Đại diện đơn vị tư vấn

Phạm Trung Kiên



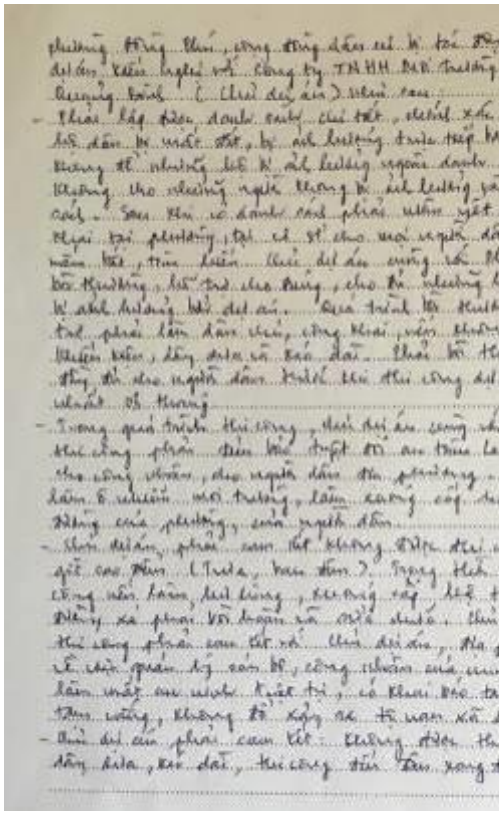
CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

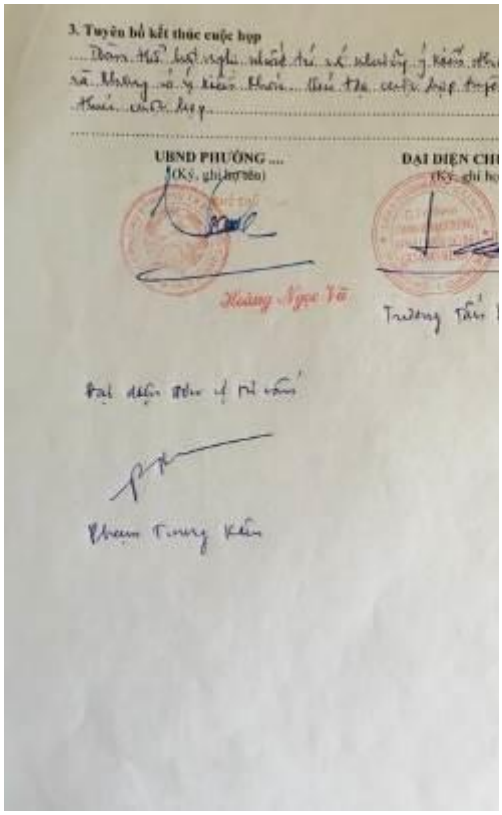
BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN

1. Thành phần tham dự:

2. Nội dung và diễn biến cuộc họp:

2.3. Thảo luận





3. Tuyên bố kết thúc cuộc họp

UBND PHƯỜNG ... (Ký, ghi họ tên)

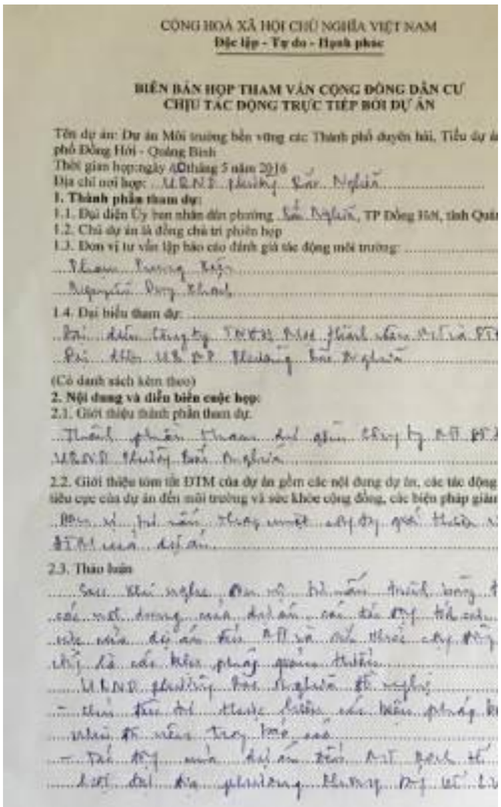
ĐẠI DIỆN CHỦ ... (Ký, ghi họ tên)

Hoàng Ngọc Tú

Trưởng Tấn ...

Đại diện đơn vị tư vấn

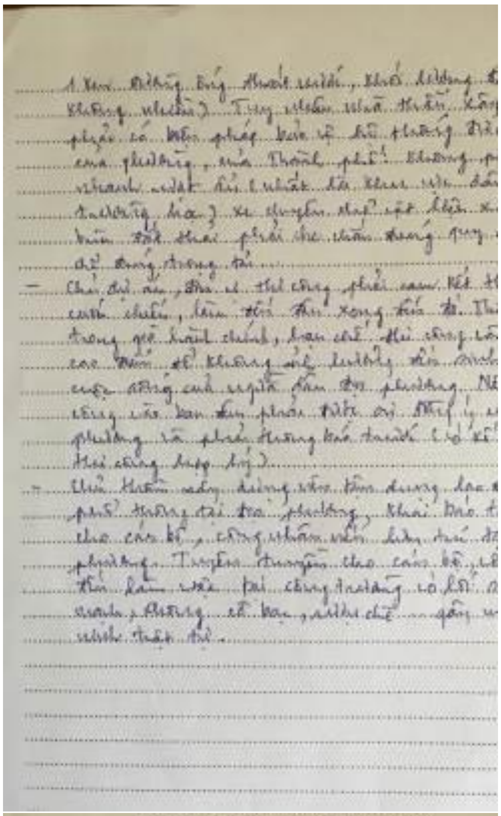
Phạm Trung Kiên



CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ
CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN

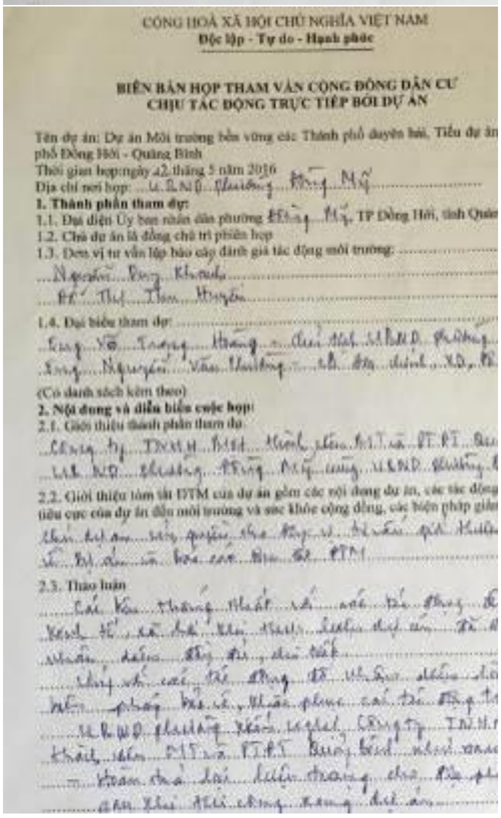
Tên dự án: Dự án Môi trường bền vững các Thành phố duyên hải, Tiểu dự án phố Đồng Hới - Quảng Bình
Thời gian họp: ngày 20 tháng 5 năm 2016
Địa chỉ nơi họp: UBND phường Bắc Nghĩa
1. Thành phần tham dự:
1.1. Đại diện Ủy ban nhân dân phường Bắc Nghĩa, TP Đồng Hới, tỉnh Quảng Bình
1.2. Chủ dự án là đồng chủ trì phiên họp
1.3. Đơn vị tư vấn lập báo cáo đánh giá tác động môi trường:
1.4. Đại biểu tham dự:
(Có danh sách kèm theo)
2. Nội dung và diễn biến cuộc họp:
2.1. Giới thiệu thành phần tham dự:
2.2. Giới thiệu tóm tắt ĐTM của dự án gồm các nội dung dự án, các tác động tiêu cực của dự án đến môi trường và sức khỏe cộng đồng, các biện pháp giảm
2.3. Thảo luận



3. Tuyên bố kết thúc cuộc họp

UBND PHƯỜNG ... (Ký, ghi họ tên)

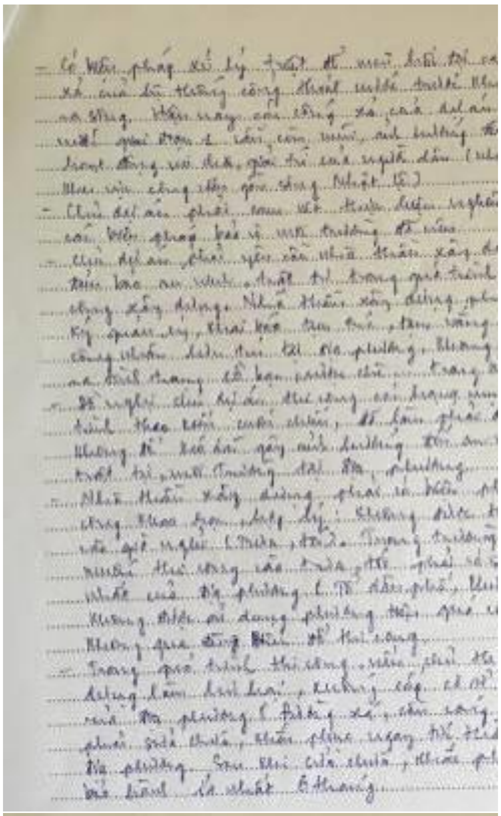
ĐẠI DIỆN CHỦ DỰ ÁN (Ký, ghi họ tên)



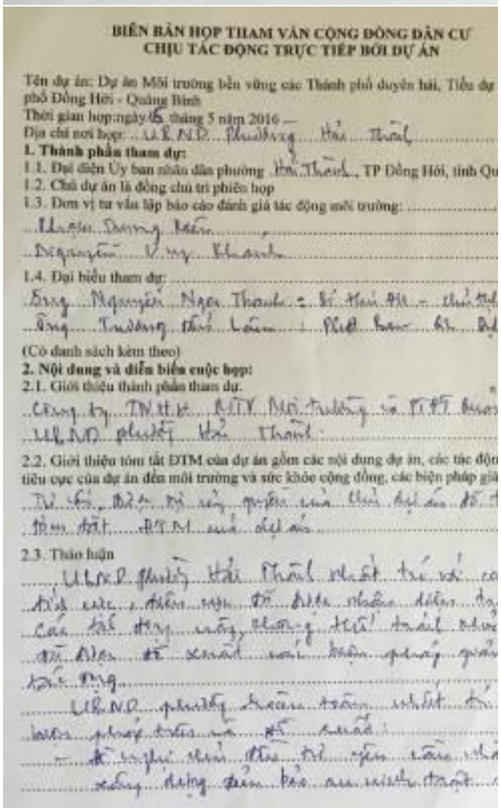
CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

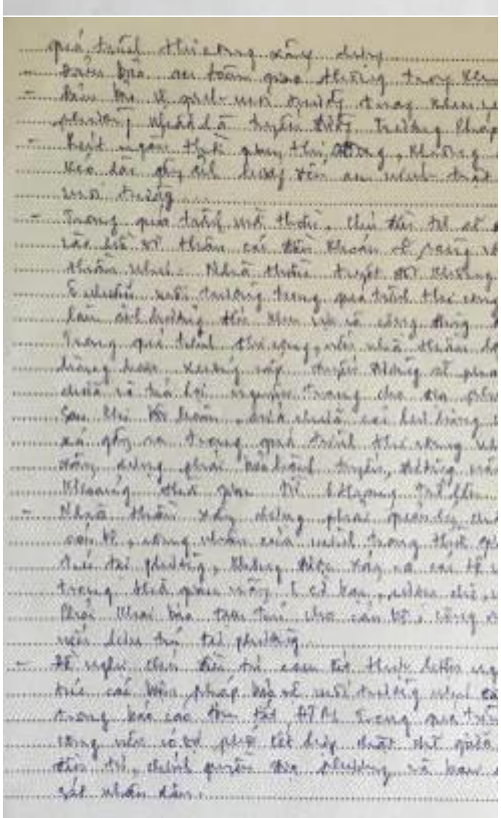
BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ
CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN

Tên dự án: Dự án Môi trường bền vững các Thành phố duyên hải, Tiểu dự án phố Đồng Hới - Quảng Bình
Thời gian họp: ngày 12 tháng 5 năm 2016
Địa chỉ nơi họp: UBND phường Đồng Mỹ
1. Thành phần tham dự:
1.1. Đại diện Ủy ban nhân dân phường Đồng Mỹ, TP Đồng Hới, tỉnh Quảng Bình
1.2. Chủ dự án là đồng chủ trì phiên họp
1.3. Đơn vị tư vấn lập báo cáo đánh giá tác động môi trường:
1.4. Đại biểu tham dự:
(Có danh sách kèm theo)
2. Nội dung và diễn biến cuộc họp:
2.1. Giới thiệu thành phần tham dự
2.2. Giới thiệu tóm tắt ĐTM của dự án gồm các nội dung dự án, các tác động tiêu cực của dự án đến môi trường và sức khỏe cộng đồng, các biện pháp giảm
2.3. Thảo luận




3. Tuyên bố kết thúc cuộc họp
UBND PHƯỜNG
(Ký, ghi họ tên)
ĐẠI DIỆN CHỦ DỰ
(Ký, ghi họ tên)


BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ
CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN
Tên dự án: Dự án Môi trường bền vững các Thành phố duyên hải, Tiểu dự
phố Đồng Hới - Quảng Bình
Thời gian họp:ngày tháng 5 năm 2016 –
Địa chỉ nơi họp:
1. Thành phần tham dự:
1.1. Đại diện Ủy ban nhân dân phường, TP Đồng Hới, tỉnh Qu
1.2. Chủ dự án là đồng chủ trì phiên họp
1.3. Đơn vị tư vấn lập báo cáo đánh giá tác động môi trường:
1.4. Đại biểu tham dự:
(Có danh sách kèm theo)
2. Nội dung và diễn biến cuộc họp:
2.1. Giới thiệu thành phần tham dự.
2.2. Giới thiệu tóm tắt ĐTM của dự án gồm các nội dung dự án, các tác độn
tiêu cực của dự án đến môi trường và sức khỏe cộng đồng, các biện pháp giả
2.3. Thảo luận



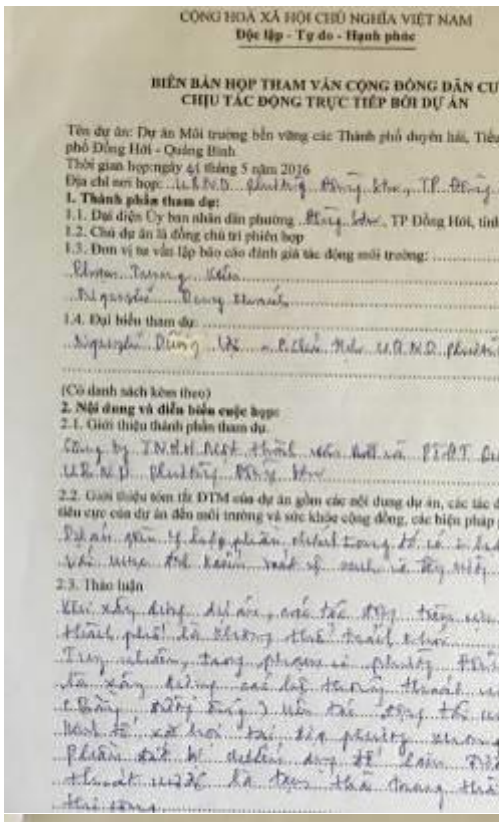

3. Tuyên bố kết thúc cuộc họp

UBND PHƯỜNG
(Ký, ghi họ tên)

ĐẠI DIỆN CHỦ DỰ
(Ký, ghi họ tên)

Nguyễn Ngọc Thanh

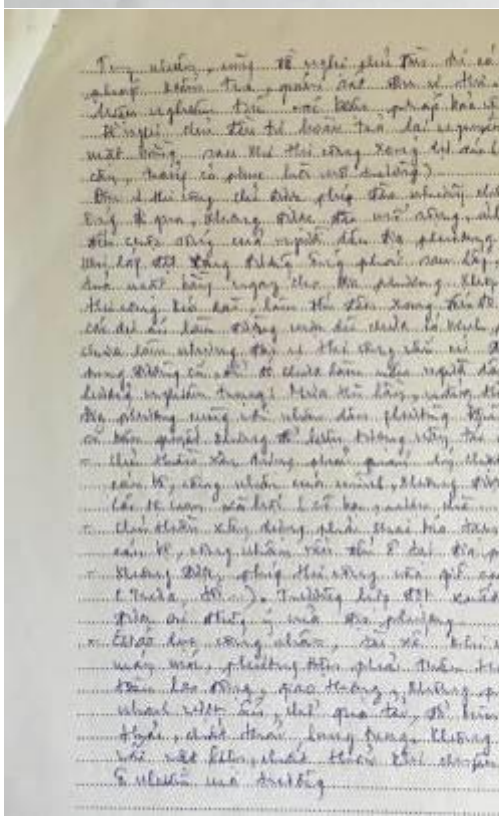
Phạm Trung Kiên


CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ
CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN

Tên dự án: Dự án Môi trường bền vững các Thành phố duyên hải, Tiểu
phố Đồng Hới - Quảng Bình
Thời gian họp: ngày 4 tháng 5 năm 2016
Địa chỉ nơi họp:
1. Thành phần tham dự:
1.1. Đại diện Ủy ban nhân dân phường
1.2. Chủ dự án là đồng chủ trì phiên họp
1.3. Đơn vị tư vấn lập báo cáo đánh giá tác động môi trường:
1.4. Đại biểu tham dự:

(Có danh sách kèm theo)
2. Nội dung và diễn biến cuộc họp:
2.1. Giới thiệu thành phần tham dự
2.2. Giới thiệu tóm tắt ĐTM của dự án gồm các nội dung dự án, các tác
tiêu cực của dự án đến môi trường và sức khỏe cộng đồng, các biện pháp
2.3. Thảo luận



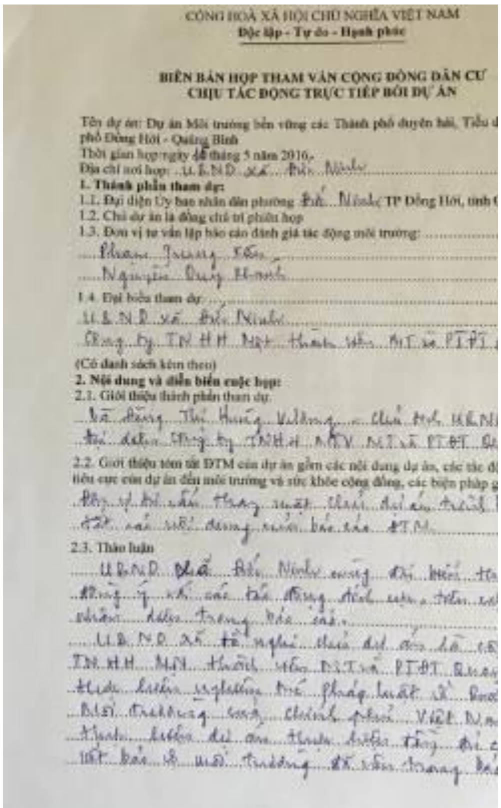

3. Tuyên bố kết thúc cuộc họp

UBND PHƯỜNG
(Ký, ghi họ tên)

NGUYỄN ĐỨC LỢI

ĐẠI DIỆN CHỦ DỰ
(Ký, ghi họ tên)

Phạm Trung Kiên



CỘNG HOÀ XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập - Tự do - Hạnh phúc

BIÊN BẢN HỌP THAM VẤN CỘNG ĐỒNG DÂN CƯ
CHỊU TÁC ĐỘNG TRỰC TIẾP BỞI DỰ ÁN

Tên dự án: Dự án Môi trường bền vững các Thành phố duyên hải, Tiểu d[...]
phố Đồng Hới - Quảng Bình
Thời gian họp: ngày 18 tháng 5 năm 2016.
Địa chỉ nơi họp: U.B.N.D. xã Đức Ninh

1. Thành phần tham dự:
1.1. Đại diện Ủy ban nhân dân phường Đức Ninh TP Đồng Hới, tỉnh [...]
1.2. Chủ dự án là đồng chủ trì phiên họp
1.3. Đơn vị tư vấn lập báo cáo đánh giá tác động môi trường:
Phạm Trung Tiến
Nguyễn Duy Hạnh
1.4. Đại biểu tham dự:
U.B.N.D. xã Đức Ninh
Công ty TNHH MTV ...
(Có danh sách kèm theo)

2. Nội dung và diễn biến cuộc họp:
2.1. Giới thiệu thành phần tham dự:
Bà Đặng Thị Hương Vương – Chủ tịch UBND ...
[illegible]
2.2. Giới thiệu tóm tắt ĐTM của dự án gồm các nội dung dự án, các tác đ[...] tiêu cực của dự án đến môi trường và sức khỏe cộng đồng, các biện pháp g[...]
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2.3. Thảo luận
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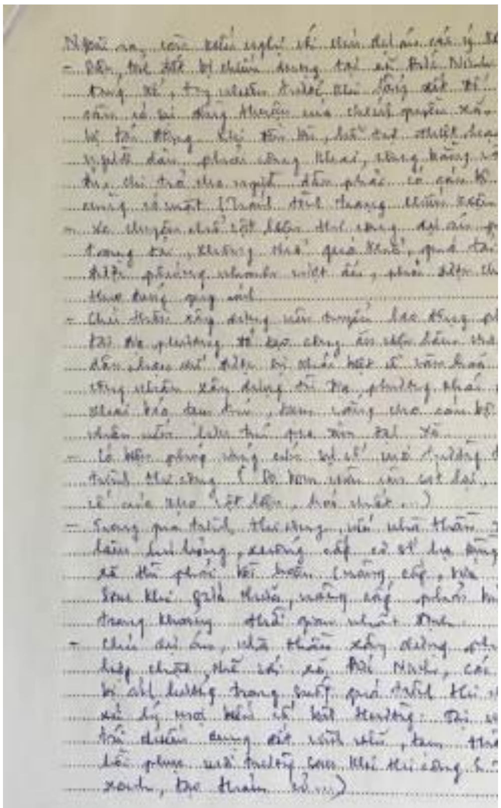

[illegible]

3. Tuyên bố kết thúc cuộc họp
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UBND XÃ ĐỨC NINH
(Ký, ghi họ tên)
Đặng Thị Hương Vương

ĐẠI DIỆN CHỦ [...]
(Ký, ghi họ tê[...])
Trưởng phòng

Đại diện đơn vị tư vấn
Phạm Trung Tiến

ANNEX 05: DUE-DILLIGENCE BORROW PITS

I. LEN ANG SON STONE PIT

1.1. Background

According to the investment report prepared by the Design Consultant, construction stones will be supplied by Len Ang Son stone pit in Ngan Thuy commune, Le Thuy district, Quang Binh city. This stone pit is exploited by Truong Thinh Corporate that was approved with the EIA report under Decision No. 571/QD-UBND dated 11/3/2015 by Quang Binh PPC. The Certificate for exploitation of mineral resources No. 997/GP-UBND dated 15/4/2015 was granted by Quang Binh PPC. The exploitation area is 3.35 ha; the reserve is 818,028m^3, exploitation capacity 50,000m^3 per year for an exploitation period of 18 years.

Len Ang Son is approved by competent natural resources and environmental management agencies of Vietnam with following documents:

- Appraisal Document No. 390/TD-PCCC (PC23) dated 29/7/2009 issued by Quang Binh provincial Department of Security;
- Certificate No. 694/DK-PCCC (PC23) dated 16/12/2009 on Fire prevention and fighting issued by Quang Binh provincial Department of Security;
- Decision No. 1382/QD-UBND dated 17/6/2012 by Quang Binh PPC approving the EIA report including Environmental Reinstatement Plan;
- Decision No. 2819/QD-CT dated 13/11/2012 by Quang Binh PPC approving "Investigation report of Len Ang Son quarry for construction materials, Van Ninh commune, Quang Ninh district, Quang Binh province" prepared by Quang Binh Import and Export JSC.;
- License No. 1884/GP-CT dated 16/8/2012 by Quang Binh PPC allowing the usage of industrial explosive materials;
- Investment License No. 29121999214 with first registration on 7/4/2009 and second registration on 26/3/2013, issued by Quang Binh PPC;
- Permit No. 1526/GP-UBND dated 03/7/2013 by Quang Binh PPC for exploitation of mineral resources;
- Decision No. 1681/QD-UBND dated 22/6/2015 by Quang Binh PPC approving charges for exploitation of mineral resources at the lime pit for normal construction materials at Len Ang Son, Van Ninh commune, Quang Ninh district, Quang Binh province by Quang Binh Import and Export JSC.;
- Decision No. 2346/GP-UBND dated 25/8/2015 by Quang Binh PPC revising charges for exploitation of mineral resources required under Decision No. 1681/QD-UBND dated 22/6/2015 by Quang Binh PPC.

1.2. **Operations**

Len Ang Son stone pit is directly managed, exploited, and operated by the Industrial Stone Exploitation Limited Company No. 1.

Upon completion of required procedures for the pit operation in July 2015, Quang Binh Import and Export JSC. developed and issued a standard process of exploitation, processing, and quality control for the stone pit, including:

- "Exploitation and processing of stone as normal construction stones at Len Ang Son stone pit", document code QT - 01;
- "Control plan for normal construction stone quality at Len Ang Son stone pit", document code QT - 02;
- "Management system monitoring plan for Len Ang Son stone pit", document code QT-03.

As stated to the aforesaid documents, safety in using industrial explosive materials and stone exploitation and processing is the most prioritized:

- Storage, transportation, and usage of explosive materials at Len Ang Son stone pit complies closely the standard QCVN 02:2008/BCT – National technical standard on storage, transportation, usage and dispose of explosive materials and the standard QCVN 05:2012/BLDTBXH – National technical standard on safety in stone exploitation and processing;
- The board of management and all staff of the Industrial Stone Exploitation Limited Company No. 1 comply strictly all legal requirements on environment, health, and safety stipulated in the standard QCVN 04:2009 - National technical standard on safety in exploitation of open-cast mines, and the standard TCVN 5178:2004 – Safety regulation on safety in exploitation and processing at open-cast stones.

1.3. Environmental Impact Mitigation and Control Measures Applied by the Stone Pit

The stone pit is surrounded with metal fences, a weighing station and a security house are located at the gate of the stone pit to prevent overloaded trucks. The stone pit is approximately 1km far from the nearest houses of local people. A camera system is installed at the administration office to monitor operation at the stone pit. The total staff and workers is 37 persons (7 officials and 30 workers), only the security man and the manager are authorized to stay overnights at the pit.

- The processing yard (the stone breaking station, the storage yard, and the loading yard) is at the northern west of the pit in an area of 38,000m^2. The milling and crushing system is at the south of the processing yard and about 100m far from the pit. The loading yard locates at the north of the processing yard in an area of approximately 25,000m^2.
- The auxiliary facilities, including office, houses, a kitchen, and the water supply system locates outside the processing yard, about 300m far from the pit at the West side, in an area of 3,500m^2. (The office is a fourth-class house with metal-sheet roof, locating in an area of 1,000m^2).
- The storage area of explosive materials is located about 100m far from the auxiliary facilities, at the west side, in an area of 200 m^2. This storage area is fenced and provided with safety warning signs.

a. Dust mitigation during drilling and mine explosion:

Because most of bore holes are watery, dust generated during the drilling process for mine explosion is insignificant.

Delay blasting is applied to limit oversized stones, and thanks to short blasting time, dust released during mine explosion is limited.

Workers are provided with safety clothes during drilling and mine explosion.

b. Dust mitigation during stone loading and transportation

Dust released during loading and transportation emits into the environment at the processing yard, the mine field, and along transport routes. To control the dust volume, the Company implement following measures:

- Constructing a $2m^3$ tank to provide moisture for grinding balls and spray water at transport routes from the mine field to the processing yard;
- Keeping finished stones moist by spraying water at the processing yard;
- Cleaning soil and stones scattered along internal and external transport routes;
- Planting tree along two sides of transport routes to prevent dust release to the surroundings, and taking care of trees around the administration house.

All trucks transporting finished stones for market consumption are always covered with tarpaulins and overloading is not allowed. *c. Dust mitigation during processing of construction stones*

During processing, dust will be generated at jaw crushers, jaw milling, and conveyor ends. Therefore, water has been always sprayed at dust-generated locations. Details are as below:

- Spraying water to material stones after pouring them into jaw crushers;
- Spraying water at cone crushers;
- Diffusing water to finished stone at conveyor ends to prevent dust emission to the ambient environment;
- Spraying water along roads at the processing yard;
- Clearing scattered soil and stone in the processing area;
- Planting trees around the processing area to prevent dust emission to the surroundings.

d. Control Measures for Exhaust Gases Emitted by Transport Trucks

To mitigate pollution of exhaust gases and fumes, the Company carry out following measures:

- Limiting operation of trucks that do not meet environmental sanitation requirements;
- Providing frequent truck maintenance, and no overloading is allowed;
- Speeds of transportation trucks do not exceed 15 km per hour.

e. Noise and Vibration Mitigation Measures During Stone Exploitation and Processing

To control noises and vibration generated by processing machines, the company install large and firm foundations for the machines. Equipment and machines are maintained periodically, and interacting sections of breaking, grinding, and screening systems that cause much of noises are lubricated properly;

Equipment and machines used for exploitation, processing, and transportation purposes are maintained frequently. Only technically appropriate loading machines and transportation trucks are deployed;

It is regulated that all operators and people working in the workshop must wear thick yet well-aerated masks;

Explosion time is agreed between the company with Van Ninh commune-level PC for time ranges from 11.00 to 12.00 am. and from 17.00 to 17.30 pm which ensure the least interruption as well as maintenance of daily activities of the nearby community.

f.Solid Waste Collection

- Overlaying soil and rocks are used for construction of internal roads and industrial levelling. The remaining is sold to other companies for levelling and backfilling purposes.

Four waste bins are provided in the production area to store domestic wastes temporarily. A contract for collection and treatment of domestic solid wastes is signed between the company and a competent agency.

g.Pollution Mitigation Measures for Water Sources

- All domestic wastewater generated from daily activities such as bathing, cooking, etc. is collected to a sedimentation chamber for treatment before being discharged to the environment;
- A system of channels, sumps, and manholes is provided around the stone pit to treat wastewater before discharging to the environment.

h.Preventive Measures and Remedial Actions for Environmental Incidents

- The stock, maintenance devices, and transportation vehicles for industrial explosive materials are designed and developed adequately with reference to safety requirements for storage and transportation of each group of industrial explosive materials;
- Charge and mine explosion must be fully stopped during stormy, lightning, and thunder conditions;
- No smoking and firing is allowed at the material area, regulations on fire prevention and fighting must be disseminated to all people for their information and implementation;
- Industrial explosive materials are stored in metal-covered tanks that are made of electrostatic soft materials;
- Safety distance during explosion must be ensured: 300m from the human and 200m from any equipment, machines, and devices;
- All calculations and safety requirements for mine explosion must be fully respected;
- Upon any signs of rain, storm, etc., all persons at the mine field must immediately leave the field and move to safety locations. If the mine field has been well prepared yet pending for mine explosion, two electrical conductors must be hold together tightly. Before putting fuses into blast holes, two electrical conductors must be twisted closely to the fuses;
- The explosion foreman keeps the key of the blaster and is the last person leaving the mine field prior to explosion. Also, he must be the first person to check the field after each blasting session. Only when he ensures that the field is safe, safety notice will be announced;
- All workers must be equipped with adequate safety clothes and tools;
- The company provide temporary shelters around the blast field for workers during mine explosion;
- Mine explosion must be carried out timely, respecting the agreed time ranges between the company and Van Ninh commune-level PC to mitigate impacts on daily activities and health of local communities and to limit occupational accidents for workers.

I,Other Measures

Periodically, the Company measure air and wastewater quality at the stone pit and pay for environmental protection charges. The company prepare environmental monitoring reports and submit to the DONRE.

The workers of Len Ang Son stone pit meet occupational health requirements, periodical health checks (at least one time per year) are provided, and the workers are often trained on safety regulations and procedures:

- The workers wear safety belts and lifelines while working along slopes and at the height of 2m against burden feet. The lifelines are not allowed to be loose more than 0.5m. Lifelines must be anchored firmly above working persons;
- Leather belts, chains, and belt lines must be tested for static loading with 300kg in 05 minutes. Leather belts and chains must be tested at least once per month, and ropes must be tested once per week before using;
- It is prohibited that workers and machines work concurrently at the vertical direction at the upper layer and the successive lower layer or locations with hanging rocks or vaulted entrances.

1.4. Compliance with Environmental and Natural Resources Requirements by the State Management Agencies

- The company exploit stone in the permitted area and the exploitation yield does not exceed the permitted threshold. An executive director has been appointed as per stipulated procedures and the Company has paid natural resources tax and environmental protection fee for mineral resources exploitation.
- An environmental impact assessment report and an environmental improvement and recovery plan have been prepared by the company and approved by the DONRE. Mitigation measures have been implemented, for example, spraying water at transport routes, stone stocks, and crushing parts of crushing machines; constructing filters, sumps, and a wastewater system to pump wastewater; planting trees around the exploitation field and the processing site; constructing protection dikes to prevent overflows of rain water; preparing periodic environmental monitoring reports; declaring and paying environmental protection charges over wastewater fees; and depositing to environmental improvement and recovery fund.
- Operation of Len Ang Son stone pit is supervised by the local authorities, including Van Ninh commune-level PC, Quang Ninh district-level PC, and Quang Binh DONRE, and by people living along the transportation routes.
- In case of any complaints and grievances about illegal operation of the stone pit, such complaints and grievances will be lodged to monitoring teams. Whereby, the commune leaders will visit the site and inform the pit manager who is authorized to respond to concerns of local communities. If responses of the pit are not satisfactory, the community leaders will submit reports to the DONRE. Upon receipt of such reports, the DONRE will conduct a field inspection to identify the complained issues and apply compulsory measures, together with a specific implementation timeline. If the stone pit fails to comply with such measures, its operation will be terminated or the pit will be closed.
- Deposit to the environmental improvement and recovery fund is supervised by the Environmental improvement and recovery fund management unit which is directly under the DONRE. If the investor of the pit fails to deposit fund at due time, the Fund management unit will send a reminding letter to the investor. If the investor, then, still does not make the required deposit, the Fund management unit will send a written request to the DONRE for punishment imposition on the investor as per legal regulations.

1.5. Transport Distance

After being classified at the pit, stones are transported to in-demand sites by trucks, following asphalt roads, with the transport distance of about 26km.

CONCLUSION:

Quang Binh Import and Export JSC. comply with Vietnam legal regulations during exploiting stones at Len Ang Son stone pit. Environmental documents are prepared adequately and mitigation measures indicated in EIA reports are implemented fully. In addition, the Company make environmental deposit as required.

II. BAI LUI AND BAI COM SAND PITS IN TRUONG XUAN COMMUNE, QUANG NINH DISTRICT OF HIEN NINH LIMITED COMPANY

2.1. Background

Bai Lui and Bai Com sand pits locate at Truong Xuan commune, Quang Ninh district, Quang Binh province. At present, the sand pits are managed by Hien Ninh Transportation and Trading Limited Company.

Operation of the sand pits started in 2015 in an area of 3ha, the reserves is 65,329m^3, the exploitation capacity is 4,000m^3 per year, and the exploitation period is 17 years. The company has constructed an auxiliary works, including an office and security house of 13m^2, an 140m^2-large yard, and a depot of 1,111m^2.

The total staff of the pits are 5 persons and there are 5 vessels.

Hien Ninh Transportation and Trading Ltd. Company is approved by Vietnam authorized natural resources and environment agencies with following documents:

- Environmental protection plan approved in 2015 by Quang Ninh DPC;
- Exploitation license No. 891/GP-UBND dated 07/4/2015 by Quang Binh PPC;
- Decision No. 2637/QD-UBND dated 22/9/2015 by Quang Binh PPC approving the Environmental Reinstatement Plan for the pit;
- The total due deposit is VND 274,537,000 and the deposited amount is VND 54,907,000 as of 2016.

2.3. Environmental Impacts Mitigation Measures

*a.**Mitigation Measures for Dust Pollution***

Sand is extracted and conveyed with barges from the pits to the depot at Hoang Long bridge (transport distance is 20km) or to the sand yard in the Nhat Le river at Phu Hai ward, Dong Hoi city (transport distance is 30km). The barges are covered with tarpaulin to prevent sand spillage during transportation.

Sand is conveyed to land by sand belt conveyors and kept at the depot. Transportation trucks are covered with tarpaulin or have closed tanks.

b.***Mitigation Measures for Exhaust Emission Generated by Exploitation Plants and Transport Trucks***

To mitigate air pollution generated by exhaust emission, the Company carry out following measures:

- Plants and equipment are inspected and maintained frequently to ensure proper and smooth operation;
- Sand dredgers and accessories/ devices are maintained periodically;
- Speed of transport trucks are limited to under 20 km per hour.

c.Mitigation Measures for Noise Pollution During Sand Extraction

To mitigate noises, the Company implement following measures:

- Plants and equipment are inspected and maintained frequently;
- Noise reduction devices are installed at smoke chambers and suction motors are located in chambers;

  Each exploitation vessel must be at its designated location; whole-bunch location is not allowed.

c.Solid Waste Collection

At each sand pit, two wastes bins are provided by the Company to temporarily keep domestic solid wastes generated by the staff.

Hazardous wastes include mostly oil-stain rags and defective fluorescent lamp with a generated quantity of about 50 kg per year. Hazardous wastes are stored in specialized wastes bins with covers, locating far from the production area.

d. Mitigation Measures for Water Sources Pollution

Preliminary treatment is given to domestic wastewater with septic tanks, then, water self-penetrates into the environment.

Dirty water generated during sand suction from the vessel to the sand yard is collected and treated with horizontal sand sedimentation tanks and storage tanks for re-use for next pumping.

A 20-30cm high dike is constructed around the sand yard to prevent spillage and penetration of sand and dirty water to the surroundings.

e. Mitigation Measures for Deep Erosion to the Bottom Sediment Layer

To mitigate deep erosion to the bottom sediment layer and instability, the Company carry out following measures:

- Whole-area exploitation is not allowed but by designated currents and sections, extraction vessels are located with GPS and exploitation maps.
- The maximum extraction depth is 1.5 meter.
- Prolong extraction at one area is not permitted to avoid deep dredging to the river bottom.
- Floats are used to locate extracted areas.
- Sand suckers go through the sediment layer to the sand layer while sucking to avoid disturbance to above layers.

f. Other Traffic and Labor Safety Measures During Exploitation

- Each vessel is provided with hood for workers' rest during travel time of each extraction period.
- Floats are used to locate exploitation currents and sections, and to gather equipment.
- All of 05 dredging vessels are provided with pennants.

- Boundaries of extracted areas are marked with floats and signal floats are provided at two ends of the extraction areas. The floats are maintained once per year.
- No extraction activities are allowed during stormy and rainy weather.

2.4. Compliance with Environmental and Natural Resources Requirements by the State Management Agencies

a. Inspection results

- Extracted amounts do not exceed the permitted threshold and floats are provided to locate extraction areas.
- An Environmental Protection Commitment has been prepared by the Company and the environmental recovery and improvement plan has been approved by Quang Binh. During operation, the Company have implemented environmental mitigation measures such as construction of filters and sedimentation chambers for sand yards, temporary storage of hazardous wastes is provided and then collected and treated by a competent company, environmental monitoring reports are prepared, and environmental recovery fund is deposited.

b. Monitoring

Operation activities of Bai Lui and Bai Com sand pits, owned by Hien Ninh Transport and Trading Ltd. Company, are monitored by local authorities, including Truong Xuan commune People's Committee, Quang Ninh district-level People's Committee, and Quang Binh provincial-level DONRE. Besides, the nearby residents.

In case of any complaints and grievances about illegal operation of the pits, such complaints and grievances will be lodged to monitoring teams. Whereby, the commune leaders will visit the site and inform the pit manager who is authorized to respond to concerns of local communities. If responses of the pit are not satisfactory, the community leaders will submit reports to the DONRE.

CONCLUSION:

Hien Ninh Transport and Trading Limited Company that extract sand at Bai Lui and Bai Com sand pits in Truong Xuan commune, Quang Ninh district, comply with Vietnam legal regulations in exploitation of mineral resources, environmental documents are prepared adequately and mitigation measures indicated in EIA reports are implemented fully. In addition, the Company make environmental deposit as required.

III.VINH TUY SOIL BANK AT VINH NINH COMMUNE, QUANG NINH DISTRICT

Vinh Tuy soil bank locates at Vinh Ninh commune, Quang Ninh district, Quang Binh province, belonging to Mr. Le Xuan Hoa who resides at Quan Hau town, Quang Ninh district, Quang Binh province. The soil bank area is 2.0 ha; the permitted borrow pit is 19,905 m^3. At present, the soil bank is still forestry land, not yet exploited.

The soil bank has been approved by Vietnam authorized natural resources and environment agencies with following documents:

- Environmental Protection Commitment No. 12/GXN-UBND dated 25 January 2016 certified by Quang Ninh district-level People's Committee;
- Decision No. 08/QD-UBND dated 25 January 2016 by Quang Ninh district People's Committee (DPC) to approve plan to lower ground level, usage of excavated materials and tree planting for reinstatement;
- Decision No. 346/UBND-TNMT dated 21 March 2016 by Quang Binh PPC allowing Mr. Le Xuan Hoa's household to use excavated soil from ground levelling.

ANNEX 06: DUE-DILLIGENCE REVIEW – RELATED PROJECT

- Coastal Cities Environmental Sanitation Project (CCESP, financed by the WB);
- Urban Environment and Infrastructure for Climate Change Adaptation Project (UEICCAP, financed by the ADB).

1. The Coastal Cities Environmental Sanitation Project (CCESP, financed by the WB)

The CCESP - Dong Hoi city sub-project –was implemented from 2007 to 2014 with following key proposed investments:

- Construction and installation of 16.2 km of combined drainage and sewers, 26.3 km of HDPE sewers and 24.1 km of tertiary drains; Installation of 11 combined sewer overflows (CSO) and 14 pumping stations;
- Dredging of 2,925m and lining 3,611m embankment of Cau Rao river, dredging 3,100 m of Phong Thuy canal;
- Construction of Duc Ninh WWTP with the designed capacity of 10,000 cmd by 2020 and 19,000 cmd by 2030; provision of a SCADA system for automatic management of the wastewater collection and treatment system;
- Improvement of Ly Trach landfill, provide equipment for solid waste collection and management, and drainage management;

The project has been successfully implemented and brought about significant positive impacts on the local population and the environment in Dong Hoi city. However, by the end of the Project, several items were not fully implemented mainly due to financial shortages. These uncompleted items have been proposed to be covered by the CCSEP: dredging and lining of 475 m of Cau Rao river, provision of 16 aerators for Duc Ninh WWTP, and provision of additional solid waste collection equipment. The lessons learned on environment management from the CCESP by the PMU are summarized below.

- Qualified and experienced social – environmental independent monitoring consultant (IMC) were recruited but monitoring efficiency was limited as they only visited the sites on semi-annual basis. Therefore, environmental monitoring by the Construction Supervision Consultant and the PMU is critical to impact management;
- The PMU's environmental monitoring capacity has been strengthened through the project implementation. The PMU's close monitoring and supervision during the construction phase was critical in ensuring Contractors' compliance with safety and environmental requirements. In addition, monitoring and supervision carried out by the WB, the DONRE and local communities helped to enhance monitoring efficiency of the project;
- The selection of pipeline alignment that follows the existing roads helped to limit land acquisition and site clearance requirements, facilitated construction and installation of drains and sewers;
- The incorporation of pollution control measures and environmental friendly solutions into technical design and cost estimation allows efficient pollution control during operation phase. The measures and solutions incorporated into engineering proposals include: covering the intake and biological ponds at the WWTP with walls and roofs so as odor-generated gases can be collected and treated through a pipe system and odor treatment unit; providing sheds for the sludge drying yard to limit odor and air pollution and prevent the spreading of sludge by rains and wind; landscape the administration area; green tree planted around the WWTP walls; umbrella palm (cyperus involucratus) and plume grass (saccharum arundinaceum) were planted in biological ponds to enhance water treatment efficiency and create beautiful landscape, and fish were added to the last ponds for monitoring as an water quality indicator, etc.;

- At pre-construction, compensation and allowances were paid on time to the households affected by land acquisition (170 HHs affected, of which 88 HHs were severely affected);

- During the construction phase, the main risks and impacts including weak geological foundation at many parts of the city, generation of 86,100 m3 of excavated and dredging materials, localized increased level of dust and noise, traffic obstruction and increased traffic safety risks, social impacts and disturbance, generation of wastes and wastewater from workers' camps, workers and public health and safety issues. Very hot and dry summer in Dong Hoi also caused impacts to the project. These impacts were controlled effectively by implementation of common mitigation measures, such as:
  - Provide adequate information about the project to the affected HHs,
  - Apply successive construction method,
  - Provide adequate protective gears for workers,
  - Apply sufficient site protection measures (fences, warning signs, barricade tapes, etc.), cover the vehicles that transport materials/ wastes, watering the roads and washing trucks periodically
  - Provide alternative temporary access to houses and shops affected with accessibility,
  - Rent local houses for the workers to live or locate the camps and site offices far from residential areas. Install insulation materials and plant trees around the camps to keep the camp cool enough when the outdoor temperature was more than 40^{o}C in summers. Equip the camps with adequate water supply, kitchens, sanitation facilities, first aids kits, with adequate drainage etc. Set flexible working hours to avoid the hottest hours in summer, between 10h30am to 2 pm, and provide protective clothes and equipment adequately to the workers working outdoor;
  - Transport dredged materials to disposal sites as soon as possible. Re-use excavated materials level filling, or dispose off them at sites far from residential areas, and level material piles at the disposal sites;
  - Store fuel, oil, and petrol in specialized cans and tanks with limited volume and place them at covered and fenced areas, and with fire extinguishers;
  - For Cau Rao river dredging and embankment lining, sediment test results showed that salinity was at 10-12.6 o/oo. Dredging materials were stored temporarily at the sites for drying (leak water was routed back to the river) and dry sludge was transported to a disposal site in Cau Cup landfill and levelled.
  - Prepare proper construction schedules for construction sites near sensitive receptors (schools, hospitals, markets, etc.), limit construction activities at school and market peak hours; use wooden boards or concrete slabs for temporary access to houses or shops affected by excavation; cover the sides of construction sites adjacent to sensitive receptors with tarpaulin, and avoid parking too many construction plants at the same time.
  - Implement road reinstatement and site cleaning immediately upon construction completion, particularly, re-establish vegetation cover and plant trees at parks and flower gardens along the Nhat Le river.
- During the operation phase, the Employer recruited a consulting firm to conduct periodical monitoring twice a year at the landfill and frequent monitoring of the WWTP. All monitoring results showed that all environmental parameters meet Vietnam standards, and these results were submitted to the DONRE and relevant provincial authorities.

- The CCSEP should continue implementing successful mitigation measures applied in the CCESP for managing potential environmental impacts; in addition, attention should be paid to: (i) Select licensed sources of construction materials nearest to construction sites, environmental control measures must be in place to minimize negative environmental impacts; (ii) Pro-actively prepare plans for re-use or treatment of excavated or dredging materials generated from construction works at Cau Rao river, bridges and access roads and

drains; (iii) Provide proper fences, barriers, and warning signs at pumping stations upon completion of earth and concrete works and waiting equipment installation; (iv) Prioritize the selection of environmentally friendly equipment, and apply software to operate PS in order to save electricity and ensure durability of the equipment.

Several photos of the CCESP:

<table>
<tr><th>Before and after construction</th><th>During construction</th></tr>
<tr><td> 
Nam Ly lake</td><td>  
Larsen sheet used</td></tr>
<tr><td>  
The Cau Rao river “before” and “after”</td><td> 
Concrete casting yard for embankment of the Cau Rao river</td></tr>
<tr><td>  
School toilets</td><td> 
Pumping station</td></tr>
<tr><td>  
Duc Ninh WWTP during construction and when completed</td><td>  
The contractors’ site office and Duc Ninh WWTP construction site</td></tr>
</table>

2. The Urban Environment and Infrastructure for Climate Change Adaptation Project (UEICCAP, financed by ADB)

The proposed Urban Environment and Infrastructure for Climate Change Adaptation Project (UEICCAP) has been proposed to be implemented in Bao Ninh peninsular of Dong Hoi city from 2017-2022 however implementation has been delayed to undefined timeframe due to changes in Project Owner. The same PMU manages both CCSEP and UEICCAP.

2.1 CEICCAP Scope of Works

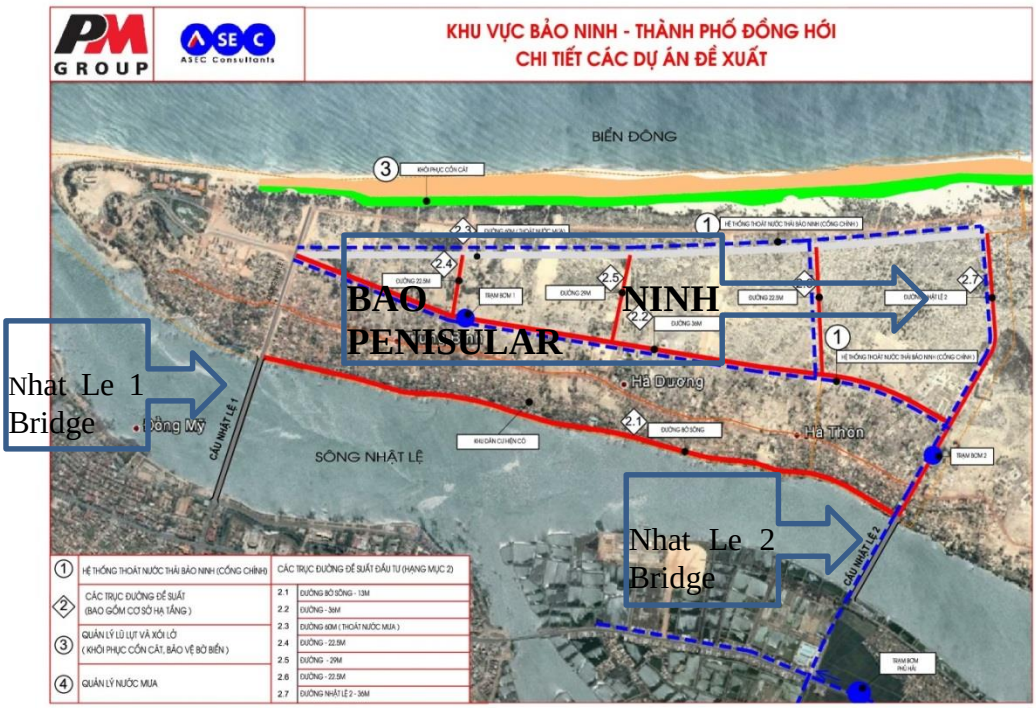
Scope of Works includes two components:

i) urban development resilience to climate change covering the Bao Ninh peninsular. The proposed investments includes: (a) installation of 16.6 km sewers and the construction of three pumping stations; (b) Construction of two main roads with total length of 7.9 km, of

rainwater storage and infiltration corridor, a 1.6 ha regulatory lake and 7 km of drains; (c) coastal protection and flood control.

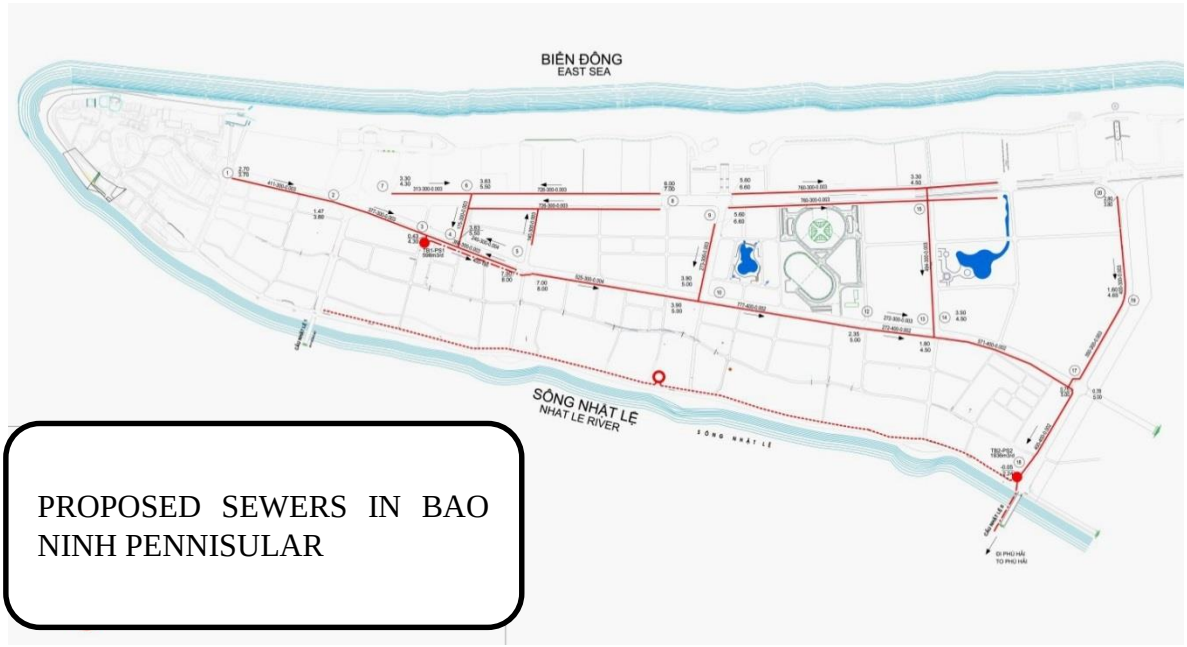
ii) improved wastewater management in Dong Hoi city. The proposed investments includes: (i) installations of 55.6 km tertiary sewers and 8238 households connections; (ii) expansion of primary and secondary sewer lines; (iii) construction of a CSO; (iv) clean up/rehabilitate 25 km of existing sewers' and (iv) dredging and lining of 300 m in Cau Rao river

Among the proposed investments of CEICCAP, the sewerage system will be connected to the sewer pipes installed together with the road proposed under Component 2 of the CCSEP. According to PMU, although dredging of 300 m at the river mouth of Cau Rao river was proposed under the CEICCAP, the work has been completed via separate arrangement of the city. There were no social or environmental issues arisen during and after construction of the mentioned works.



2.2 Applied Environmental Screening and Tools of the CEICCAP

Environmental screening carried out by the ADB determined that key impact of the project relates to land acquisition while potential negative environmental impacts are limited, mostly during construction phase, and mitigable through common measures incorporated into construction practice. The proposed CEICCAP has been classified as environmental category B by the ADB. Subsequently, an Initial Environmental Evaluation (IEE) has been prepared by the Project owner, reviewed and approved by the ADB. The main findings and recommendations of the IEE are summarized below:



- The potential impacts on the natural environmental will be limited at cutting down some trees at road sides and existing 200 pine trees planted at the coastline. "One to one" compensation has been proposed to compensate for affected trees. The main construction impacts will be traffic disturbance, temporary congestion, usage of community resources, and community disturbance due to dust, noise and gas emission. A comprehensive Environmental Management Plan (EMP) combined with contractual environmental framework has been proposed to manage the construction impacts
- For the wastewater component, the CEICCAP applied the Sustainable Urban Development System (SUDS) approach with proposed investments which promote rainwater infiltration into the soil.
- Due diligence review of the Nhat Le 2 bridge (which is under construction and would be completed by the end 2016?) and the CCESP conclude that there are no major environmental issues arisen from these two projects.

2.3 Key Potential Impacts and Mitigation Plan

Key potential social and environmental impacts and a proposed management plan are summarized in the below table:

Component/ Activity	Potential Impacts/ Risks	Mitigation Measures
Site clearance	Overcutting of trees Conflict due to delays in implementation	- Monitor tree cutting, keep the number of trees to be cut down at minimal - Replant on "one for one" basis - Land acquisition certificate is required
Workers camps	Surface and ground water pollution due to untreated wastewater Stagnant water causes waterborne diseases (mostly dengue fever) Health risks: illness due to unhygienic conditions; Epidemic risk in camps	- Wastewater must be treated before being discharged - Create and maintain adequate drains to ensure there is no stagnant water - Monitor wastewater quality at outlet - Clean up the camp periodically with approved solutions
Garages and workshops	Soil and water pollution, pollutants follow rain water to pollute the Nhat Le river	- Install oil and sedimentation traps - Storage, handle and transport hazardous products following guidelines on usage and storage of hazardous products

Solid waste, including	Soil and water pollution caused by domestic and construction wastes	- Promote recycling and reuse; Identify and use acceptable disposal site - Contractor prepare solid waste management plan covering: (i) awareness raising for the public; (ii) collection and storage of construction waste, waste separation and recycling; (iii) collection and transportation; and (iv) service provider for solid waste collection
Excavation and filling	Safety risks related to UXO	- Arrange for mine clearance before site clearance
Traffic	Public safety related to traffic safety risks Traffic jam Air pollution: dust and exhaust gases	- Select appropriate transportation route and monitor drivers' attitude - Contractor prepare traffic management plan - Maintain construction plants periodically, set speed limit, watering
Hazardous substances	Water pollution due to spills Fire Accident	- Storage areas must be contained and safe - Keep records of usage - Identify and use oil recycling business - Contractor prepare and implement hazardous waste management plant - Provide portable fire fighting equipment and set up safety procedures - Provide training for the workers - Contractor prepare hazardous substances management plan and Emergency response procedures

Comment: the assessment cover key potential impacts of the proposed investments and adequate mitigation measures were recommended. As Bao Ninh peninsular is connected with the CCSEP project area through the existing Nhat Le 1 (and Nhat Le 2 in the future) only, the physical interactions between the CEICCAP and the CCSEP are expected to be limited. The main interaction would be mostly at the roundabout at the in-land end of Nhat Le 2 bridge, on which sewer pipelines installed under the CEICCAP would be connected to the sewers installed under component 2 of the CCESP. Traffic safety issue during the construction and operation phase at that location were discussed and adequate management measures were covered in ESIA of the CCSEP. As one PMU manage both projects, no issues are expected to be arisen with regard to connection of the sewers installed under the two projects.

2.4 Other Contents of the EMP

EMP implementation arrangements with responsibilities of relevant stakeholders including the head of the PMU's environmental unit, construction supervisors, contractors, etc. clearly identified. Grievance Redress Mechanism was described. The EMP also proposed to hire environmental consultant to support the PMU on environmental management and training. Environmental monitoring program and cost estimation was included in the EMP.

The EMP also specified key contents of each specific plan that a contractor would be required to prepare before construction commencement.

2.5. Public Consultation

Consultation was conducted during the preparation of the IEE with 49 people from Bao Ninh peninsular. The participants expressed their willingness to relocate, if required, in a village near the river as the majority of them had been living on fishery catching. They also requested to relocate affected graves in certain months of each year. Apart from request of timely construction, the participants had no concerns.

2.6. Conclusions

Conclusion: the potential negative social and environmental impacts of the CEICCAP are limited. Environmental assessment and management plan for the CEICCAP has been prepared with a quality acceptable to the World Bank. As one PMU will manage both the CEICCAP and the CCSEP, no issues are expected to be arisen, relating to connection of the sewers installed under the two projects. Therefore, no additional recommendations are made to the CEICCAP.

DUE DILIGENCE REVIEW - LY TRACH LANDFILL, DONG HOI CITY

The review is based on the Environmental Monitoring Report for Ly Trach landfill prepared by Quang Binh Environmental Monitoring Centre in Quarter 1, 2016.

1. **Background**

Solid waste collection and management in Dong Hoi city, including management of Ly Trach landfill, has been undertaken by Quang Binh Environmental and Urban Development Co. Ltd. (URENCO). Ly Trach landfill locates in Ly Trach commune, Bo Trach. The site is surrounded with eucalyptus.

The CCESP supported Dong Hoi with various equipment to enhance URENCO's solid waste collection and management capabilities, including solid waste collection vehicles, handcarts, and waste bins. The CCESP also helped to develop further the Swiss-funded Ly Trach Landfill, including wetland construction, drainage improvement, a hazardous waste facility, additional landfill equipment and vehicles, including a bulldozer.

Currently, about 85 tons of solid wastes are collected and disposed off daily at Ly Trach landfill. The existing disposal cell has a capacity of 995,395m3 and can operate until 2038. The cell is protected with a combined clay layer for the bottom and HDPE membrane for the cell walls.

2. Landfill Operation

There are five workers working directly at the landfill (a leader, one working at the scale, one on chemical spray, one guard and one bulldozer driver).

The truck carrying solid waste transported to the landfill goes through the scale before entering the disposal cell. Name of garbage truck driver, plate number, the type and amount of the wastes in the truck, entry time are recorded at the scale gate. Flags are placed within the cell to guide truck drivers where to dispose off the garbage. Bulldozer will level and compact the waste, layer by layer, each layer should be less than 30 cm thick. By doing so, the light materials in the waste would not be blown by the wind, and there is no stagnant water in the cell. When the height of the waste dump reach 2m, a 0.2 m layer of soil will be applied on top. Covering the waste with soil will help to reduce vermin attraction, odor littering, and the amount of rain water entering the waste.

Bio-chemicals are also applied for vermin control, at rate of 0.4 l/T for EM, 0.35 kg/T for Bokashi, 0,00041 l/T for fly control biochemical, 0.26 kg/T for powder lime; These chemicals are provided by licensed suppliers such as the Advanced Technology Application Centre and the Quang Binh Pharmacy Company Ltd.

Water supply for domestic uses and chemical mixing are from 60 m drill well within the landfill.

3.Potential Environmental Impacts and Applicable Mitigation Measures

a. Air Quality Reduction: Gases such as CH_4, NH_3, CO, SO_2, NO_2…emitted from the landfill, odor and microbial dusts from the disposal cell and smell from truck spread along the roads

   Mitigation: There is no gas treatment facility at Ly Trach landfill. The potential impacts of gases are managed through operational practice: follow O&M, levelling and compaction, covering the compacted garbage with soil having clay accounting for more than 30% to facilitate levelling and compaction. Soil cover is spread evenly until reaching the thickness of about 20cm. On the other hand, two stacks are installed to allow emission of landfill gases to prevent fire and explosion; Bio-chemicals are applied for odour and vermince control.

b. Wastewater generation: Stormwater usually washes down some solids polluting the lower area and cause erosion risks. There is small volume of domestic wastewater generated by the workers. There is some black wastewater from toilets. Leachate is generated during decomposition of organic wastes and from rainwater infiltrated into the waste. The leachate volume is insignificant.

   Mitigation: The exiting drainage is adequate to collect and discharge stormwater runoff surrounding the disposal cell in the landfill. Gray wastewater is collected in maholes and treated before being discharged. Septic tank toilets are used at the landfill.

   Leachate from the disposal cell is collected through collection pipe and led to the anaerobic treatment pond in which the leachate will be sinked at the bottom or float and create a membrance. Anaerobic treatment helps to reduce BOD and consume least BOD. The partially treated effluent will then enter the second pond for anaerobic treatment at the bottom combined with aerobic treatment on and near the surface. In the third pond, the wastewater continues to be treated with the presence of water hyacinth, a floating plant known to be able to uptake some nutrients and heavy metals. Finally, wastewater is led to the fourth pond in which gravels were placed further treatment of suspended solids for before being discharged into the environment.

   Circulation of leachate from anaerobic pond to the disposal cell would promote bio-degradation and reduce generated leachate volume. However, the leachate circulation pump has not been working for a while, thus leachate treatment efficiency has been limited.

4.Environmental Monitoring and Reporting

The Center for Environmental Monitoring and Technology has been contracted to carry out environmental monitoring and prepare monitoring report for the Ly Trach landfill every six months. The scope of services includes: Sampling air quality at five locations, wastewater at three locations, groundwater at one location, make assessment based on the measurement data and observations.

The results of environmental monitoring carried out in June 2016 conclude that:

i) In general, ambient air quality meets applicable standard and there were very small variations compared to 2015 monitoring results.: Pm10 was at 0.06-0.12 mg/m^3, below allowable level at 0.3mg/m^3, the concentrations of NO_2 varies between 0.018 to 0.036mg/m^3, lower than allowable limit at 0.2mg/m^3. SO_2 levels were at 0.03 -0.05mg, below limit (0.35mg/m^3);

ii) The parameters in treated wastewater are within allowable limit;

   COD was at 359mg/l in untreated wastewater (UW), at 163mg/l in treated wastewater (TW). BOD_5 was reduced from 210mg/l in UW to 96 mg/l in TW. Amonia (NH_4^+) was at 45mg/l in UW and at 18 mg/l in TW. Nitrogen (N^+) was at 19mg/l in UW to 10.5 mg/l in TW;

iii) Groundwater quality meets the applicable standards QCVN, except Mn exceeded the standards.

5.Conclusions

Ly Trach landfill has been improved through a number of internationally-funded project, including the CCESP. URENCO has also been supported with solid waste management equipment. Operation of Ly Trach landfill is under control, although there are rooms for improvement. The most recent environmental quality monitoring results show that most of the air, water and groundwater quality are within the allowable limits.

ANNEX 07- CCSEP DONG HOI DREDGING AND DREDGED MATERIALS MANAGEMENT PLAN

1.Location of Dredging, Volume and Characteristics of Dredged Materials

Dredging of 475m of the Cau Rao river at section indicated in the photo below. The river bed will be dredged to the design level from -1.2 to -1.7m . The contractors will carry out both dredging of the parts underwater and excavation of the soil, including top soil, on the embankments. The total dredged sediment is 13,214 m^3, equivalent to 35,017 tons

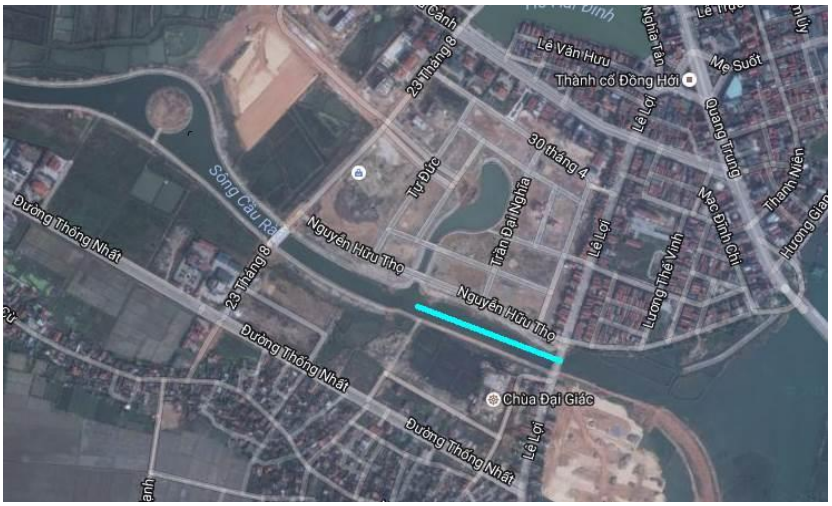


Figure 7.1 : Dredging section

According to the analysis, the sediment in Cau Rao River is moderately saline, at 10.4 – 10.7‰. Therefore, temporary storage and final disposals of the dredged materials must be carried out with care, mitigtion measures must be applied to prevent water leaked from saline water from entering agricultural/vegetated land.

2.Final Disposal Site

All dredged sediment of Cau Rao river will be disposed off at Cau Cup landfill which is an old landfill of Dong Hoi city and currently reserved for disposal of construction wastes only. The landfill area is 13 ha, surrounded mostly by bushes, and rubber trees and eucalyptus are planted at the distance of 0.5-1km. Disposal of dredged sediment at Cau Cup landfill has been approved in written by Dong Hoi City People's Committee.

Dredged materials and water drained from the material may cause soil and water pollution, and cause harm or kill terrestrial flora including existing trees. Temporary disposal of dredged materials would disturb the existing vegetation cover at riverside. Construction methods and procedures of storing dredged sediments are developed to minimized negative impacts on the environment and the temporary storage area.

3.Dredging Method

Below are the dredging methods proposed during project preparation phase. The contractor may proposed adjustments or alternatives provided that the pollution control requirements are met.

Successive dredging method will be applied. Dredge the upstream section (200 m) first, then the downstream section (275m). Dredging will be done in dry season and take place within 4-5 months (from February to August). For each section, coffer dams made of eucalytups timber and sand bags shall be built at the two ends. Pump river water out of the dredging section and the ponds for temporary diposal of dredged materials. Use excavators and buckets to dredge the river to the designed elevation, at -1.2 to -1.70 m. Stored wet dredge materials temporarily at the abandoned pond by the side Cau Rao river, directthe leakage water to run back to the Cau

Rao river. Transport the dry dredge materials to the Cau Cup landfill. Isolate the dredge materials from the surrounding soil and vegeation, ensure proper drainage.

Figure7.2: Temporary Storage Area for Dredged Sediments at Cau Rao River

As the dredged sediment with salinity of 10.8% might be scattered in rain water, the storage cell will be lined with tarpaulin to prevent saline water from entering/damaging vegetated land surrounding the cell.

4.Contractor's Dredging Management Plan

The Contractor is required to prepare a Contractor's Dredging Management Plan (CDMP) and submitted to the Environmental Consultant of the Construction Supervision team and the PMU Environmental Officer for review and approval. The CDMP will include, but not limited to the followings:

1) The Scope of Works in the Contract package, construction method and schedule

2) Volume and quality of water quality and sediment quality in the dredging area covered by the contract

3) Water users that may be affected by the dredging and embankment lining

4) Materials uploading and transportation method: indicate proposed route of the transport from the dredged site to the disposal area, time of operation, type of vehicles/trucks and proposed measures to reduce the leakage of the dredged materials from the transport trucks,

5) Schedule to inform the nearby communities about the project, disclosure of name and contact number for possible complaints.

6) Potential social and environmental impacts, including the site-specific impacts and risks

7) Mitigation measures to address the potential impacts and risks. The mitigation measures should be proposed based on ESIA/ECOP, ESMP, SEMP, the potential impacts and mitigation measures presented in Section 4 and 5 of this Plan and the following requirements:

8) Environmental Quality Monitoring plan carried out by the contractor (particularly pH,DO, TSS, BOD, salinity etc. for water and heavy metals including pH, Hg, As, Cd, Cu, Pb, Zn and Cr, for sediments and soil

For soil and sediment: The total dredged sediment is 13,214 m3, equivalent to 35,017 tones. The contractor will take finve sediment samples and test for pH, Hg, As, Cd, Cu, Pb, Zn, Cr, Organic Materials and Mineral OilsAt

9) Results of Consultation with affected community about the draft CDMP.

4.Guidance on the Potential Impacts and Mitigation Measures to be included in CDMP

Avoid dredging in the rainy season, from September to December, in order to maintain drainage function of the river;

- In addition to relevant mitigation measures for common construction impacts, the dredging plan shall meet the following requirements:
  - Coffer dams are built before dredging to separate the construction site with the remaining sections of the Cau Rao river;
  - Disturbance to the ground and on riverbed is kept at minimal; Monitoring is carried out regularly ensure temporary storage of dredged materials in abandoned aquaculture pond would not cause pollution to the surrounding; sedimentation trap is installed surrounding these ponds;
  - Brackish wastewater leaked from dredging materials will be led to flow back into the Cau Rao river;
  - During dredging time, since the flows are low, pipes will be used to direct the runoff discharged from the existing balancing lake and seven stormwater drains to the downstream of the Cau Rao river;
  - When storm is forecasted, dredging or embankment lining activities will be limited, site protection measures are implemented; all construction activities will be halted in stormy weather ;
- Dredging equipment must be operated at slow speed in intervals to allow sedimentation;
- Provide warning signs at dangerous areas, for example, underflows, erosion points, or deep excavation;
- Specified safety equipment such as lifebuoys are provided to the workers and force the use when working in the water. Assign observers throughout work shifts for timely rescue in case of emergency;
- Dai Giac pagoda is located 200m from the dredging area and is a sensitive receptor. Construction schedule should plan to limit construction activities on the first and the full moon days of lunar months; tidy up the site regularly, spray water to mitigate dust at least twice a day in hot and rainy day, do not park construction plants or load materials within 50 m from the pagoda gate. Workers should be informed about the requirements to limit impacts to the pagoda;
- Wet dredged sediment with salinity of 10.‰ will be stored temporarily at the abandoned aquaculture ponds adjacent to the dredging section (as illustrated in Figure 1.10). Each pond is 500m^2 large, 1.5 m deep, 750m^3 in capacity. Before storing the dredged sediment, the Contractor shall dry the pond by pumping the water into the river, and create path for leakage water to go back to the Cau Rao river. After 3-5 days in the lake, dredged sediment will be transported to Cau Cup disposal site;
- Saline dredged materials and soil will be disposed of in a separate areas at the Cau Cup landfill; the bottom and the surroundings of the disposal areas shall be lined with impermeable materials, surface runoff is led to the existing drains so as it can be diluted before entering waterbodies;
- When salinity in the dredged materials (at 30 cm deep) is reduced to below 2‰ (at which most plants can tolerate), apply top soil at least 30 cm thick and plant trees on the top.