YEN BAI PROVINCE PEOPLE'S COMMITTEE
YEN BAI PROVINCE CONSTRUCTION INVESTMENT PMU

ENVIRIONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

(Final Report)

DYNAMIC CITIES INTEGRATED DEVELOPMENT PROJECT
YEN BAI CITY – YEN BAI PROVINCE SUB-PROJECT

Yen Bai, March 2018

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YEN BAI CITY – YEN BAI PROVINCE SUB-PROJECT

CLIENT	CONSULTANT
YEN BAI CITY PROJECT MANAGEMENT UNIT	VIETNAM INFRASTRUCTURE ENGINEERING CORPORATION

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ABBREVIATIONS

MONRE	Ministry of Natural Resources and Environment
CC	Climate change
PMU	Project Management Unit
SW	Solid waste
ESIA	Environmental-Social Impact Assessment
ODA	Official Development Assitance
QCVN	National technical regulation
QCXDVN	Vietnam construction regulation
DONRE	Department of Natural Resources and Environment
TCVN	Vietnam standard
PC	People's Committee
AH	Affected household
HH	Household

EXECUTIVE SUMMARY

Bases of the sub-project

The Dynamic Cities Integrated Development Project (DCIDP) will support class II cities to enhance their pivotal growth potentials at the present and in the future in order to become provincial and regional urban economic centers, in line with Vietnam Urban Development Masterplan up to 2025 and vision up to 2050 and World Bank's policies. The sub-project aims at providing improved urban infrastructure services and supporting integrated urban planning and management in the participating cities in accordance with the cities' approved masterplans.

There are 5 cities/towns involved in the sub-project, namely Thai Nguyen (Thai Nguyen Province), Yen Bai (Yen bai Province), Hai Duong (Hai Duong Province), Tinh Gia (Thanh Hoa) and Ky Anh (Ha Tinh Province), each of which will be benefiting from considerable resources, thereby speeding up regional and local economic development.

The sub-project comprises 2 components (i) Structure – Rehabilitation and construction of urban infrastructure system that will improve the accessibility and quality of essential urban infrastructure services, such as water drainage and supply, environmental sanitation, urban roads and bridges. (ii) Non-structure – Technical assistance and investment implementation that helps enhance economic planning capacity and space planning, with reasonable strategies and efficient infrastructure investment for the city.

Legal and technical bases of ESMP

The sub-project has been classified in group B of environmental projects given its potential risks and impacts which are site-specific, reversible and controllable through available measures. World Bank's safeguard policies applicable to YenBai city sub-project include: (a) Environmental assessment (OP 4.01); (b) Natural environment (OP/BP 4.04); (d) Cultural resources (OP/BP 4.11); (e) Involuntary resettlement (OP/BP 4.12). Environmental-social impact assessment report (ESIA) and Environmental and social management plan (ESMP) have been prepared in accordance with OP 4.01.

Description of the sub-project

Yen Bai city sub-project comprises the components similar to those of DCIDP: Structural solutions – Rehabilitation and construction of urban infrastructure system: Sub-component1: Flood control and urban safety: (1) Nam Cuong lake 1 rehabilitation and embankment construction: Embankment length: L=2,365 m, dredging at an average depth of 0.5 m; (2) Lake 2: Embankment length L=840 m; (3) Lake 3: Embankment length L=1041 m; (4) Cau Dai stream embankment construction (embankment length L=3,755m and auxiliary works); (5) Hao Gia stream embankment construction (embankment length L=1,510m and auxiliary works). Sub-component 2: Urban transport and connectivity enhancement: (6) Construction of a road from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge L= 1,035 m.(7) Construction of a road connecting Bach Lam bridge to Van Phu bridge L=4,678 m. (8) Construction of a road connecting Nguyen Tat Thanh intersection to Au Co intersection L=4,200 m; (9, 10, 11, 12, 13) Sub-component 3: Resettlement: Construction of resettlement site no. 1 → 5 with a total area of 3.1 ha. Component 2: Non-structural solutions – Technical assistance and investment implementation: Develop urban strategy planning, public transport development planning, other consulting services. List of works under the sub-project will be prepared for 3 – 24 months (from May 2019 to May 2022).

Social and environmental bases

Base environmental data in 14 locations in the sub-project are demonstrate that air quality in this area is sound according to QCVN 05:2013/BTNMT and QCVN 06: 2010/BTNMT, only

noise in some locations on Khe Dai stream, roads no. 1,2,3 and resettlement sites is 1.02 – 1.08 times higher than QCVN 26:2010/BTNMT. The existing surface water is good according to QCVN 08 – MT:2015/BTNMT (10 samples). Underground water quality is within the allowed limits according to QCVN 09-MT:2015/BTNMT (10 samples). Wastewater quality survey in the sub-project area under QCVN 14:2008/BTNMT shows that BOD5 is 1.05 – 1.21 times higher than the allowed limits, TSS is 1.21 – 1.35 times higher and coliform is 1.54 – 1.92 times higher. 8 mud samples taken in the sub-project area show that heavy metal parameters are all within the allowed limits under QCVN 03-MT:2015/BTNMT. Lake and stream bottom sediment sludge were surveyed in 7 locations, and it was found that heavy metal parameters are all within the allowed limits. Mud and sediment can be used for heightening civil structures, cultivation or may be disposed. As such, the environment in the sub-project area shows no sign of pollution and all the surveyed parameters fall within the allowed limits.

Conditions of the existing work items: (1) Lake 1: embankment has not been constructed, bank has been eroded, lake bed has not been dredged and has been sedimented, agricultural eco-system has been formed in some sections because local residents encroach on the banks to practice cultivation of crops. (2) Lake 2: banks are frequently eroded; lakeside road elevation is higher than lake bottom. Lake 3: concrete road is available but embankment has not been constructed, leading to frequent soil fall-in. (4) Hao Gia stream embankment: some sections subject to frequent soil fall-in have been embanked (1,350m embanked/ total length of 2,860m), frequently flooded at a depth of 1.8 - 3m, civil structures caused flow congestion; (5) Khe Dai stream embankment: the stream is subject to sediment and garbage dump that causes flow congestion, some bridges are made by local people; subject to frequent soil fall-in and flooding. 750m/ total of 2630m has been embanked. (6) Road from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge (road no. 1): currently a road for several HHs scattering around.(7) Road connecting Bach Lam bridge to Van Phu bridge – road no. 2: is a new road without intersection with the existing roads in some sections. (8) Road connecting Nguyen Tat Thanh intersection to Au Co intersection – road no. 3: consists mainly of low hills and mountains, lakes and ponds, an earth road near the residential area is available. (9) Resettlement site no.1: currently production forest land, consisting mainly of mixed wood trees and bushes, an earth road is available in the front. (10) Resettlement site no.2: provincial road 168 in the front leading to the site, which is currently unused land; (11) Resettlement site no.3: currently production forest land, vegetation consists of mostly acacia and mixed wood trees, a rural concrete road is available in the front, (12) Resettlement site no.4: currently mixed gardens, a pathway is available, located near Ha Noi – Lao Cai railway. (13) Resettlement site no.5: currently gardens and production forest land including fruit trees, acacia and bushes.

Most of the sub-project area is far from residential areas, sparsely populated or empty, distance to the nearest residential area is 5 – 100m. Sensitive areas include: school, healthcare station, communal house, temple and pagoda. But the construction site is mostly behind these sensitve areas.

Environmental and social impacts

Potential negative impacts have been identified and screened for each component of the sub-project in the preparation, construction and operation stages and are classified by nature of the construction activities. Most of negative impacts are of temporary, local and reversible nature due to medium construction scale. The impacts can be limited by adoption of appopriate technologies and specialised minimising methods. In the meantime, the contractor must exercise strict control and consultation with local people.

Major impacts: dust, gas, vibration, wastewater, solid waste from worker's construction operations and living activities, which are evaluated as from low to medium and may be mitigated.

Typical impacts

Typical impacts in the construction phase: (1) Impacts on the eco-system from the dredging of lake 1: given that the lake bed eco-system is poor, terrestrial eco-system consists of crops cultivated on the reclaimed virgin soil in the lake bed, aquatic eco-system includes principally frog, toad, crab, etc., the impacts are negligible. (2) Soil fall-in, erosion, sedimentation: from low to medium level, especially in rainy season of June, July, August. (3) Impact of electric pole displacement: may affect workers and local people at low level, but incidents may seriously affect health, life and mentality of victims. (4) Construction activities taking place near railroad may be dangerous. (5) Impacts on local people's production forest: these are mild impacts since the forest is economically inefficient. (6) Traffic disturbance: may occur on roads no. 1,2,3 and Hao Gia and Khe Dai stream embankment routes. The impact level is low because other alternative routes are available (inter-hamlet, inter-group roads) and this is not the only road on this route. (7) Discrepancy in elevation of the works and that of people's houses and structures, causing inconvenience to local people, but this impact is short-lived and can be alleviated by suitable measures. (8) Local floding during the construction of the works in rainy season from April to September.

Impacts on the sensitive areas: (i) Nam Cuong lakes 1,2,3 embankment construction: 7 sensitives areas include multi-purpose communal house, health station, Cau Den communal house, Nam Cuong Primary School, Son Ca Kindergarten, war matyr cemetery, Van Thang pagoda, (ii) Khe Dai stream embankment: sensitives areas include Yen Ninh health station, Minh Tan market, Kim Dong Primary School, Hoa Hong Kindergarten. (iii) road no. 1: no sensitive area; road no. 2: 5 sensitive areas include Yen Bai Vocational College, Van Phu commune communal house, Nam Cuong Secondary and Primary School, Tuy Loc hamlet communal house, Van Phu temple and pagoda; road no. 3: 5 sensistive areas include Nguyen Tat Thanh High School, Nguyen Hue High School, Nguyen Trai Primary School, Tan Thinh commune health station and Tan Thinh church.

Typical impacts in the operation phase: (1) Impacts from change of terrain and flow (2) Transport: increased traffic accidents due to high traffic volume and non-compliance with road traffic regulations, (3) transformation of land use purpose on two sides of the embankment, roads and residential areas, which will affect agricultural production and food supply to local people, but the impact is mild because this area is under uneconomic cultivation.

Risks and unexpected situations

In the construction phase: (1) Labour accident; (2) Traffic accident, (3) Fuel and chemical spill, fire, explosion, electric shock (4) uncovering archaeological relics and tombs, (5) drowning from falling into culverts, food poisoning, plagues.

In the operation phase: (1) Embankment erosion, bridge over embankment breakdown, collapse/settlement of roads (2) drowning from falling into culverts, lakes or streams (3) railway and road accidents due to adjacence to road no.2 and residential area no. 4.

Mitigating measures

Based on evaluation of negative environmental impacts, risks and unexpected situations and consideration of socio-economic and environmental elements, mitigating and preventing measures and response to the environmental considerations will be devised. Mitigating measures put forward for each of the above impacts in each phase of the sub-project include overall plans (ECOPs), specific plans, mitigating measures for sensitive areas social impact mitigating measures.

Specific mitigating measures in the construction phase: (i) Mitigating impacts on the eco-system in dredging lake 1 by appropriate construction time, road sign arrangement, traffic

guide; (ii) Mitigating soil fall-in, settlement, sedimentation: appropriate construction plan and methods, (iii) Mitigating impacts from removal of electric poles: arragement of technical staff, making appropriate management and removal plans; (iv) Mitigating impacts from the railway: establish specific regulations and resolution of specific cases. (v) Mitigating impacts on production forest: carry out the compensation, subsidy and resettlement (if any) in adherence to the policy framework of Yen Bai Province, (vi) Mitigating impacts from traffic disturbance: make detailed construction plan and publicise information, avoid loading and transportation of construction materials in rush hours, (vii) Mitigating elevation discrepancies with local people's house: conduct surveys and consult with local people, grant subsidy to HHs with elevation lower than the connective works, (viii) Mitigating impacts from local flooding: devise countermeasures against worksite flooding, closely watch weather and climate.

Mitigating measures in operation phase: (i) Air pollution, dust, noise, vibration: clear road surface, collect scattered waste, water the roads, (ii) Wastewater: regularly collect solid waste, frequently check culvets and ditches along the embankments and roads, (iii) Garbage: check sewers and drainage ditches, collect garbage regularly and rules for users must be established when the works come into operation.

Mitigating measures for typical impacts in the operation phase (i) Change in terrain and flow: monitor weather and climate developments, strictly comply with regulations for use of embankments and roads, (ii) Transport: arrange sufficient traffic signs, appropriately organise traffic flows, boost propaganda through local media, (iii) Transformation of land use purpose: acknowledge local people's feedbacks and their desire for conversion of land use purpose, disclose urban construction plans and policies, handle conflicts promptly, made public relevant information.

Mitigating measures and unexpected situations:

During the construction phase, mitigating measures and unexpected situations are conformity to the current regulations for labour safety and training and compulsory working rules, provision of sufficient labour protective equipment, review and remind staff of daily works, healthcare, erection of warning and instruction signboards, first aid the victims and transfer him/her to the nearest hospital, preparation of back-up plan and flood response plan, make temporary canals available for drainage of rainwater, arrange pump and power generator ready in emergency cases, rehabilitate the drainage system, set up fences and warning sign posts, giving instructions on handling of gas, chemicals and waste, strictly comply with fire control regulations, arrange fire control equipment and prepare disaster response plans, arrange pump to accelerate drainage in case of heavy rain, closely watch weather, etc. Mitigating measures and unexpected situations in the operation phase are: closely watch, regularly check the work items of the sub-project, communicate the issues relating to incidents, conduct periodic and regular repair and maintenance, remodel the defective parts before rainy seasons, etc.

Environmental and Social Management Plan (ESMP)

ESMP of Yen Bai city sub-project covers mitigating measures for negative impacts, roles and responsibilities for execution of ESMP, superintendent, environment policy framework, reporting procedures, environmental control program, capacity building program and cost for ESMP execution. According to which, environmental quality monitoring cost is approximately 0.018 million USD, independent monitoring consulting cost is 0.107 million USD and capacity building cost is 0.006 million USD.

During the construction phase, ESMP requests the engagement of some related parties and ministries, each with its own role and responsibilities, including Yen Bai Province PMU, Yen Bai Department of Natural Resources and Environment, Contractor, Construction Supervising Consultant (CSC), Independent Environment Supervising Consultant (IESC) and local people.

Yen Bai City Investment and Construction Project Management Unit will be responsible for overall supervision of the implementation of the sub-project, including the compliance with policies for environment and will assign Environment Staff (ES) to support the environmental issues of the sub-project. CSC will designate ES and supervice all construction activities to make sure that the Contractor obeys the provisions under the contract, ECOPs and mitigating measures; CSC and IESC will also asisst provincial PMU in reporting and maintaing contact with local people. Based on the agreed environmental values stated in the tender and the contract, the Contractor will prepare its ESMP (CESMP) for each construction site, submit it to the Province's PMU and CSC for review and approval prior to commencement of construction. People are entitled and responsible to supervise the compliance with environmental regulations during the construction of the works to assure that their rights and safety are protected and mitigating measures have been conduted effectively by the Contractor and Province PMU; the execution of the sub-project at the proposal of Yen Bai Province Department of Natural Resources and Environment and PMU to ascertain that is is executed in accordance with stiplations of law. Yen Bai Province Department of Natural Resources and Environment is responsible to supervise the compliance with environmental regulations.

Public consultation and information disclosure

Public consultation: The sub-project will be carried out in 7 commune/towns in 05 wards and 02 communes in Yen Bai city; public consultation was conducted in 2 batches: batch 1 in April-May 2017 and batch 2 in August – September 2017. The public consultation sessions were attended by representative of local governmen, organisations and households affected by the sub-project. Government and residents in the wards/communes in the sub-project area are totally agreeable to the execution of the sub-project as this will generate socio-economic and environmental benefits, creating a driving force for socio-economic growth towars sustainable development. But due attention should be paid to environmental sanitation, particularly dust and gas pollution, damage to local roads and progress of the works.

Information disclosure: The first draft of ESIA and ESMP in Vietnamese were disclosed in the offices of 7 wards/communes and Yen Bai City Invsetment and Construction Project Management Unit in October 2017. The final draft of ESIA/ESMP in Vietnamese were disclosed in the offices of 7 wards/communes and Yen Bai City Invsetment and Construction Project Management Unit on 25 November 2017. The final draft in English was disclosed in the internal website and made public in November 2017.

INTRODUCTION

A. GENERAL INTRODUCTION

A.1. Project origin

The "Dynamic Cities Integrated Development Propject" (DCIDP) will support Class-II cities[1] to bring their growth potentials into full play at present and in the future, as well as to reinforce their role as the provincial and regional economic centers, in line with Vietnam's urban development master plan up to 2025 and vision to 2050 and with WB's objectives. The project's aim is to provide improved urban infrastructure services and support comprehensive urban planning and management for the project cities. In compliance with the approved master plans of the project cities, the project will provide capital for strategic urban infrastructure development in oder to help the cities: (i) Improve accessibility to and reliability of urban services for at least 40% of the total population; (ii) Enhance the development of neighboring areas in connection with high quality public spaces and public transport system; and (iii) Support continued socio-economic growth (e.g. by local economic productivity enhancement, infrastructure obstacle elimination, connectivity enhancement, local job opportunity improvement, etc.) The project will also support the project cities to address basic urban development challenges via technical support to improve urban planning and management, contributing to sustainable urban development and development of neighboring areas.

There are 5 sub-project cities of 5 provinces: Thai Nguyen (Thai Nguyen Province), Yen Bai (Yen Bai Province), Ninh Binh (Ninh Binh Province), Tinh Gia (Thanh Hoa Province) and Ky Anh (Ha Tinh Province). Each city of the project benefits from significant resources, thereby boosting regional economic growth in the past decade. Development objectives of DCIDP are to provide improved urban infrastructure services and support integrated urban planning and management in the project's cities. The project is expected to consist of 2 components:

Structural component: A series of investments will be provided to each subproject city to improve accessibility and quality of key urban infrastructure services, including water supply and drainage, environmental sanitation, urban roads and bridges. The selection of infrastructure sub-projects will be adjusted to comply with updated master plan of each city and priorities will be given to: (i) Improving accessibility and reliability of urban services for at least 40% of the total population; (ii) Enhancing development of neighboring areas in connection with high quality public spaces and public transport system; and (iii) Supporting continued socio-economic growth; (iv) Meeting acceptable economic and technical standards.

Non-structural component: A technical asistance and project implementation assistance package will be provided for the provincial people's committees of the project's cities in order to enhance economic and spatial planning capacity of these provinces to ensure strategic

Grade-2 urban centers serve as political, economic, cultural, scientific-technical, education-training or service centers or interchanges in inter-provincial regions or the whole country; Having a high level of socio-economic development, promoting the socio-economic development of a province or inter-provincial region. The size of the urban population is 200,000 people or more. The density of the urban population is 5 thousand people / km2 or more. The proportion of non-agricultural labor is 80%, the system of urban technical infrastructure reaches 80% or more with the synchronous urban social infrastructure, the completion level reaches 80%.

compliance and efficiency of the infrastructure investments for the cities. This assistance package is provided under the project's non-structural component. The technical assistance activities will include the following fields to well meet specific demands of each project cities: (i) Comprehensive socio-economic plan; (ii) Integrated urban planning and management (including public transport development strategy); (iii) Urban asset management; (iv) Disaster risk management and mitigation; and (v) Sector development planning for key sectors.

A.2. Yen Bai City Sub-project

Yen Bai is the center of politics, economics, culture, science and technology of Yen Bai province. It is the driving force of the eastern key economic development region of the province and is identified as one of the subregional centers of the 14 mountainous provinces of the Northern Midlands. Due to the divided terrain caused by many streams and complex geological tectonic conditions, many areas in Yen Bai city have low-lying terrain; On the other hand, because the rainfall in Yen Bai province is higher than other provinces in the region, every year, in rainy season, Yen Bai city is seriously affected by climate change, many parts of the city are subject to flooding and landslides, therefore, have caused tremendous impacts on the socioeconomic life of the people and the security of urban populations.

Although the province has made strong remedying efforts, but due to the low starting point of the economy and limited resources, investment in the technical infrastructure of the city is not adequate with the urban development demands. Increasing urban population puts great pressure on the urban infrastructure and urban management system. In addition, the economic structure has shifted sharply, reducing the weighting of agro-forestry -fishery products, increasing the proportion of industry, construction and services; Despite the rising living standards of the city people, Yen Bai city should continue to attract resources and investors to create incentives and key areas to promote the development of the city in particular and Yen Bai generally.

In the planning and development of the Northern Midland and Mountain area, the Government has identified Yen Bai as the driving force of the Northern Midland and Mountainous provinces - in line with the Ministry's Resolution 37-NQ/TW. Politics and Decision No. 1154/QD-TTg dated 28 August 2012 by the Prime Minister approving the adjustment of master plan for socio-economic development of Yen Bai province up to 2020.

Investment has been made in the construction of technical infrastructure and social infrastructure of Yen Bai City in order to ensure the quality of people's life, such as the Northern Mountainous Area Urban Program Phase 1, the Red River embankment for erosion control, the bypass of Yen Bai city, the Tuan Quan bridge, Bach Lam bridge, each worth hundreds of billions of VND for each project. However, because of the province's limited resources, the capital allocation is inadequate with the needs and level of development, investment and construction needs; Therefore, most of the projects are not synchronized and responsive to the actual requirements of urban development in the current period and in the future, i.e, synchronous construction of urban transport system, technical infrastructure, enhanced capacity to adapt to climate change, control of bank erosion for rivers, lakes, streams, waste water collection and treatment, etc. Therefore, the Yen Bai Province People's Committee proposed the project "*Dynamic Cities Integrated Development - Subproject of Yen Bai City, Yen Bai*

Province" in accordance with World Bank policies and criteria. World Bank (WB) on the National Strategy for Cooperation in Vietnam.

The sub-project's components are are as follows:

Component 1: Structural solution – Improvement and construction of the urban technical infrastructure system:

- *Sub-component 1*: Flood control and urban safety
- *Sub-component 2*: Development of urban corridor and connectivity enhancement
- *Sub-component 3*: Resettlement

Component 2: Non-structural solution – Technical assistance and investment implementation

(i) Development of integrated urban planning strategy integrated with public transport development

- Focus on renovation of urban land development strategies;
- Develop a green urban development strategy in response to climate change and disaster reduction;
- Develop a strategy to regulate the urbanization process in tandem with the economic growth of Vietnam's key economic centers;
- Develop urban infrastructure, underground infrastructure and regional connectivity strategy;
- Develop a major suburban development strategy related to agricultural population transition and green belt development management;
- Develop a Public Space Development Strategy and implement Urban Design.

(ii) Natural disaster and flood management modelling.

As such, ESIA/ ESMP are required only for Component 1 of the Sub-project during the preparation, construction and operation of the Project.

A.3. FS and ESIA report approving agency

FS Report approving agency: Yen Bai PPC

ESIA Report approving agency: Yen Bai Province Department of Natural Resources and Environment.

B. COMPLIANCE WITH RELEVANT PLANS AND PROJECTS

B1. Compliance with plans

Compliance with national plans:

In the past years, thanks to the support of the Government and international organizations, Yen Bai City has been implementing many projects for socio-economic development, improvement of infrastructure system and environment of the city. The "Dynamic Cities Integrated

Development Project – Yen Bai City Sub-project" is highly compliant with the National Plan, in particular:

(i) Decision No.758/QD-Ttg approving national urban upgrading program (2009 – 2020 period), with the following objectives: Directly supporting the implementation of master plan of Vietnam's cities; Enhancing urban residents' living conditions by rehabilitation of technical, social, environmental infrastructure services. This subproject will help construct roads, river/stream/reservoir embankments; inner, outer city and regional connection; improve living conditions and environmental landscape as well as enhance socio-economic development. Hence, Yen Bai City Sub-project is considered to be compliant with this strategy's objectives.

(ii) Decision No. 2623/QD-Ttg approving "Vietnam Cities Development in Response to Climate Change" scheme (2013 – 2020 period), with the following objectives**:** Actively coping with climate change; Properly using resources in urban upgrading and development; Enhancing awareness and the co-operation between central agencies and localities. The sub-project, with components for flood control and sanitation, climage change resilience urban management enhancement, has well proved its compliance with the established scheme.

(iii) National climate change strategy: Climate change impacts, combined with urban development, will significantly affect hydrological regime of Yen Bai City's rivers and streams. Therefore, there needs for a comprehensive solution with suitable measures to control flooding in rainy season by soil fall-in embanking, flow clearance and improvement of temporary rainwater storage capacity of the eco-lakes, allowing for urban water drainage efficiency. As a result, the proposed sub-project with investments in lake, stream embankment in Yen Bai City that prevents soil fall-in and fill-up, creating more water storage area, is highly compliant with the given objectives. Besides, the calculation and selection of scale of these work items have been integrated with the published climate change scenarios.

Compliance with regional plans:

(i) **Plan for development of Northern Midland and Mountainous Region up to 2030 of the Prime Minister under Decision No. 980/QD-TTg:** The objectives are to connect developed plain areas with mountainous developing areas; form economic – urban centers, and socio-technical system to reduce pressure for Hanoi Capital; connect, co-operate with large urban centers in the region with Hanoi Capital and with Northeastern coastal region; co-operate for development with the urban, rural system of Vietnam – China and Vietnam – Laos regions, as such, planning development of central urban centers to connect small and medium urban centers nearby to form dynamic urban clusters to help boost the socio-economic development of Northern Midland and Mountainous Region, along the national and regional transport route connections forming economic – urban corridors to promote comprehensive development of the Northern Mindland and Mountainous region. In order to address the urban challenges for improving the quality of infrastructure services, the subproject will build roads linking the existing roads, namely the construction of riverside roads to Dien Bien Road linking the Tuan Quan and Van Phu bridges, linking Nguyen Tat Thanh intersection and Au Co intersection, forming connections with Dien Bien Road, Red Riverside Road, National Highway 70, flooding by-pass, National Highway 37, etc. The project's objectives are totally compliant with the development plan for the Northern Mindland and Mountainous region.

(ii) **Socio-economic Development Master Plan for Northern Midland and Mountainous Region up to 2020 of the Prime Minister under Decision No. 1064/QD-TTg:** The objective is to significantly and uniformly improve the socio-economic infrastructure system, better meeting the economic development and welfare demands, step by step narrowing the development and living standard distance between the local people and that of the country. This project, upon its completion, will create the roads that connect highway routes, the inner and outer routes, as well as the economic, commercial, service areas of the city. The sub-project is totally compliant with this socio-economic master plan.

Compliance with local plans

(i) Decision No. 1154/QD-TTg dated 28 August 2012 on adjustment of Socio-Economic Development Master Plan of Yen Bai Province up to 2020: The aim by 2020: Maintain reasonable and sustainable economic growth rate; Improve people's material and spiritual life: Develop a convenient infrastructure system that well facilitates the Province's socio-economic development, in which, transport infrastructure construction must be one step ahead. Develop inter-regional, inter-provincial, inter-district transport system. Thus, the mentioned sub-project complies with Yen Bai Province's socio-economic development master plan up to 2020.

(ii) Decision No. 2598/QD-UBND dated 25 December 2014 of Yen Bai PPC on approval of Development Plan for Yen Bai Province to 2030 and Vision to 2050.

This decision is to help develop Yen Bai City into an administrative, political, industrial, commercial, service, tourism, sporting, healthcare, education center and the economic driving force of the province; Implement the approved urban development programs, including accommodation areas, resettlement areas, centralized service areas, etc., with a particular focus on expanding the city to the right of Red River, aiming at becomeing a Class-II city by 2020, and Class-I city by 2050. With the plan's urban transport development orientations, the sub-project "complies with the Province's general development objectives".

(iii) Transport Development Plan of Yen Bai Province for 2016 – 2020 Period, Vision to 2030 dated 06 June 2017

The objectives of the master plan include the planning of the transport system, the main trunk road, the planning of technical infrastructure for the construction of rainwater drainage and sewerage systems, the planning of water and power supply, wastewater drainage and sanitation, public works, commercial services, housing, housing services, park space, greenery and gardens on the route, in line with urban space architecture and nature of each area. The transport development plan of Yen Bai Province in the 2016-2020 period approved the Yen Bai subproject funded by the World Bank being among the targets of urban transport planning prioritized by the city.

(iv) Decision No. 399/QD-UBND dated 23 April 2012 of Yen Bai PPC on approval of development master plan for Yen Bai City and neighboring areas:

The orientation is for Yen Bai City to become a Class-II city by 2020, and a Class-I City by 2030 – "Double core" development: The old urban area left of Red River – Rehabilitation, maintenance of the "forest city" image; the urban area right of Red River – New urban area with the image of economic development and modernization on the basis of ecological city in

harmony with nature. The sub-project's objectives comply with the city's development master plan.

(v) Socio-economic Development Plan for 5 Years of 2016 – 2020 of Yen Bai City: According to the five-year socio-economic development plan, the plan for improvement of the income and livelihoods, improve the quality of life and contribute to urban renewal. The Yen Bai City Subproject with proposed objectives will contribute to the completion of the five-year socio-economic development plan 2016-2020.

All investment items on roads, embankment, ecological lakes and resettlement sites will be considered in accordance with national planning and strategy, regional planning, provincial planning and Yen Bai City.

B2. Related projects

In the past years, Yen Bai Province has focused its resources on construction of urban infrastructure system for Yen Bai City. Yen Bai Province has made proper resource mobilization, combining different fund sources for construction of socio-technical infrastructure system to ensure life quality of the people in the city in particular and in Yen Bai Province in general. Some infrastructure investment projects have been being implemented in Yen Bai City are shown in the table below:

Table 1: Summary of the relevant projects

No.	Project/program name	Investment contents	Remarks
1	Northern Mountainous Cities Program – Phase 1 Fund source: WB Client: Yen Bai City's People's Committee	- Rehabilitating LIA area in Hong Ha Ward - Upgrading the road section from Km4 to Van Phu Bridge - Upgrading Hoang Van Thu Road - Upgrading Ha Huy Tap Road - Rehabilitating pavement of the roads of Quang Trung, To Hieu, Ngo Sy Lien, etc. → All work items have been completed, paving the way for the implementation of the items in Van Phu, Tan Thinh communes and Dong Tam ward of the sub-project.	- Implemented in 2015 – 2016 - Cost: 165 billion dong
2	Projecct "Flood detour road for Yen Bai City – section connecting Km5 central area and NR 32C" Fund source: WB Client: Yen Bai Province's Department of Transport	- Total road length: L = 10.3km, roadbed width B = 50m → All work items have been completed, paving the way for the implementation of the items in Van Phu, Tan Thinh communes of the sub-project.	- Time: 2012 - 2013 - Cost: ~ 1000 billion dong
3	Tuan Quan Bridge,	- Whole-bridge width: B = 17m;	- Time: 2015 - 2017

No.	Project/program name	Investment contents	Remarks
	Yen Bai City, Yen Bai Province Project Fund source: WB Client: Yen Bai Province's Department of Transport	whole-bridge length till abutment end: L = 414.6m →In finishing stage	- Cost: 722,634 billion dong
4	Construction of Bach Lam Bridge connecting NR 37 and Noi Bai ÷ Lao Cai Highway Client: Yen Bai Province's Department of Transport	- The bridge consists of 7 beam spans from beginning to end: (2 x 39) m + (75 + 120 + 75) m + (2 x 39) m; Bridge length L_c = 435.5 m. → In finishing stage	- Time: 2016 – 2020 - Cost: 512.036 billion dong

The Tuan Quan Bridge, Yen Bai City, Yen Bai Province Project and the Project for Construction of Bach Lam Bridge connecting NR 37 and Noi Bai ÷ Lao Cai Highway are underway but have no impacts on the construction works under the DCIDP. As such, these projects are not considered as connective projects to DCIDP

B3. Vietnam's legal documents

This sub-project will have to comply with Vietnam's current environmental laws, including Environmental Protection Law No. 55/2014/QH13 dated 23 June 2014, Decree No. 18/2015/ND-CP dated 14 February 2015, the laws, decrees, circulars, decisions, standards and regulations of Vietnam on environment, Circular No. 27/2015/TT-BTNMT dated 29 May 2015 of Minister of Natural Resources and Environment on instructions for strategic environmental assessment, environmental impact assessment, environmental protection commitment, and relevant laws. Specifically:

** Laws*

- Environmental Protection Law No. 55/2014/QH13 of the National Assembly of Vietnam dated June 23, 2014. This law enacted policies and regulations on environmental safeguards, and rights and obligations of organizations, households and individuals related to environmental protection activities.
- Land Law No. 45/2013/QH13 ofthe National Assembly of Vietnam dated November 29, 2013 prescribes the regime of land ownership, powers and responsibilities of the State in representing the entire-people owner of land and uniformly managing land, the regime of land management and use, the rights and obligations of land users involving land in the territory of the Socialist Republic of Vietnam.
- Law on Water Resources No. 17/2012/QH13 of the National Assembly of Vietnam dated June 21, 2012provides on management, protection, exploitation and use of water resources, as well as the prevention of, combat against and overcoming of harmful effects caused by water in the territory of the Socialist Republic of Vietnam.
- Law on Biodiversity No. 20/2008/QH12 of the National Assembly of Vietnam dated November 13, 2008provides for the conservation and sustainable development of biodiversity; rights and obligations of organizations, households and individuals in the conservation and sustainable development of biodiversity.

- The Law on Construction No. 50/2014/QH13 approved on 18th June 2014 by 7th National Assembly of the Socialist Republic of Vietnam;
- The Law on Road Transport No. 23/2008/QH12 dated on 13/11/2008;
- The Law on Complaints 02/2011/QH13 dated 11 November 2011;
- The Law on Culture Heritage No. 10/VBHN-VPQH dated on 23/7/2013;
- The Law on Safety, Labor Sanitation No. 84/2015/QH13 dated June 25, 2015;
- The Law on Dike No. 79/2006/QH11 dated on 29/11/2006;
- The Law on Plant Protection and Quarantine No. 41/2013/QH13 dated on 25/11/2013;

** Decrees:*

- Decree No. 38/2015/ND-CP of 24 April 2015 of the Government on management of waste and discarded materials;
- Decree No. 18/2015/ND-CP dated February 14, 2015 of the Government on environmental protection planning, strategic environmental assessment, environmental impact assessment, and environmental protection commitment.
- Decree No.19/2015/ND-CP of 14 February 2015 of the Government detailing the implementation of a number of articles of the Law on Environmental Protection;
- Decree No.43/2014/ND-CP dated May 15, 2014 of the Government providing guidance on detailed implementation of some articles from the Land Law 2013.
- Decree No.44/2014/ND-CP dated 15 May 2014 of the Government providing regulations on land prices.
- Decree No.47/2014/ND-CP dated 15 May 2014 of the Government on compensation, support, and resettlement when land acquisition is required by the State.
- Decree No. 155/2016/NĐ-CP dated 18 November 2016 of the Government prescribing administrative sanctions for environmental protection.
- Decree No. 25/2013/ND-CP of 29 March 2013 of the Government on environmental protection charges for wastewater;
- Decree No. 67/2012/ND-CP of the Government dated 10 September 2012 on the amendment of Decree No. 143/2003/ND-CP of the Government dated 28 November 2003 on detailing the implementation of a number of articles of the ordinance on exploitation and protection of irrigation works
- Decree No. 113/2010/NĐ-CP dated 3 December 2010 of the Government on valuation of damages caused to the environment.
- Decree No. 174/2007/ND-CP of 29 November 2007 on environmental protection charges for solid waste;
- Decree No. 59/2007/NĐ-CP dated 09/4/2007 of the Government on the management of solid waste.

** Circulars:*

- Circular No. 27/2015/TT-BTNMT dated 19 May 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment, and environmental protection plan.
- Circular No. 36/2014/TT-BTNMT dated 30 June 2014, specifying detailed methods of valuation of land prices, construction, adjustment of land prices; specific land prices valuation and land prices valuation consulting service.
- Circular No.37/2014/TT-BTNMT dated 30 June 2014, providing detailed regulation compensation, assistance, and resettlement when the State acquires land.
- Circular No. 30/2014/TT-BTNM, regulating the records for land allocation or land lease, the change of land use purposes, land acquisition
- Circular No. 36/2015/TT-BTNMT dated 30/6/2015 of Ministry of Natural Resources and Environment on hazardous waste management.
- Circular No. 22/2010/TT-BXD dated 03/12/2010 of Ministry of Construction providing labor safety in construction
- Circular No. 19/2011/TT - BYT of 06 June 2011 of the Minsitry of Health guiding labor hygiene, laborers' health and occupational diseases.
- Circular No 13/2007/TT-BXD of December 31st 2007 providing guidance on a number of articles of Decree no. 59/2007/ND-CP dated 09 April 2007 by the government on solid waste management.

** Decisions*

- Decision 04/2008/QD-BXD dated April 03, 2008 of Ministry of Construction on Vietnam Building Code.
- Decision No. 52/2012/QD-TTg, dated November 16, 2012 on the support policies on employment and vocational training to farmers whose agricultural land has been recovered by the State.
- Document No. 2318/VPCP-QHQT dated 14 March 2017 by the Office of Government approving proposal for Dynamic Cities Integrated Development Project funded by WB;
- Document No. 799/UBND – XD dated 26 April 2017 by Yen Bai PPC on financial mechanism for the Dynamic Cities Integrated Development Project, Yen Bai City, Yen Bai Province Sub-project funded by WB;
- Document No. 2312/UBND-XD dated 07 October 2016 by Yen Bai PPC on assigning duties to owners of the projects funded by World Bank and Arab Saudi;
- Document No. 1640/UBND-XD dated 08 August 2017 by Yen Bai PPC approving investment policy for the Dynamic Cities Integrated Development Project, Yen Bai City, Yen Bai Province Sub-project funded by World Bank.
- Other relevant documents by Yen Bai PPC.

** Applicable standards and codes*:

- QCVN 01:2009/BYT – National technical codes of potable water quality;
- QCVN 02:2009/BYT– National technical codes of domestic water quality;
- QCVN 03-MT:2015/BTNTM – National technical codes of allowed limits of heavy metals in soil;
- QCVN 05:2013/BTNMT – National technical codes of surrounding air quality;
- QCVN 06: 2009/BTNMT – National technical codes of some toxic substances in surrounding air;
- QCVN 07: 2009/BTNMT – National technical codes of harmful waste limits;
- QCVN 08-MT:2015/BTNMT – National technical codes of surface water quality;
- QCVN 09-MT:2015/BTNMT – National technical codes of groundwater quality;
- QCVN 14:2008/BTNMT – National technical codes of domestic waste water quality;
- QCVN 26:2010/BTNMT – Nationa technical codes of noise;
- QCVN 27:2010/BTNMT – National technical codes of vibration;
- QCVN 40:2011/BTNMT – National technical codes of industrial waste water;
- QCVN 43:2012/BTNTM – National technical codes of deposit quality;
- QCVN 07:2010/BXD: National technical codes of urban infrastructure facilities;
- QCVN 18:2014/BXD – National technical codes of construction safety;
- TCVN 6705:2009 – Normal waste. Classification;
- TCVN 6706:2009 – Harmful waste. Classification;
- QCXD VN 01:2008/BXD – Vietnam construction codes – Construction planning;
- TCVN 7957:2008 - Drainage and sewerage - External networks and facilities - Design standard.
- TCXDVN 33:2006 - Water supply - Distribution system and facilities - Design standard.
- Other relevant sector technical regulation and standards.

B4. Activated socio-environmental safeguard policies of World Bank

The following safeguard policies of World Bank are activated: (i) Environmental assessment (OP/BP 4.01); (ii) Compulsory resettlement (OP/BP 4.12); (iii) Tangible culture resources (OP 4.11).

Policy OP/BP 4.01 – Environmental assessment [2]

The construction and rehabilitation of the urban infrastructure under the subproject involve: i) new construction of urban roads; ii) upgrading of drainage canals and associated urban roads and bridges; iii) construction of balancing lakes; and iv) construction of resettlement areas. Construction and operation of these urban infrastructure would have adverse environmental and social impacts requiring appropriate mitigations measures which are addressed in details in subsequent chapters of the ESIA.

This OP 4.01 policy requires that right since the project preparation phase, the socio-environmental impacts and risks must be well screened and assessed so that proper mitigation measures and socio-environmental management plans can be proposed for ech project phase to help minimize negative impacts during project implementation course. OP/BP 4.01 also requires that the affected community of the project must be consulted during preparation of ESIA/ESMP. ESIA/ESMP reports must be locally disclosed before project appraisal.

The majority of the potential adverse impacts relate to land acquisition and construction activities. These include commonly known construction impacts and risks, such as: i) safety risks related to unexploded ordinances; ii) increased level of dust, noise, vibration; iii) pollution risks related to generation of waste and wastewater, particularly large amount of excavated/dredging materials; iv) traffic disturbance, and increased traffic safety risks; iv) interruption of existing infrastructure and services; v) disturbance to daily socio-economic activities in project area and social disturbance; vi) health and safety issues related to the public and the workers at construction sites; vii) social impacts associated with construction disrupting businesses by construction related activities and mobilization of workers to the construction site, etc.

The Dynamic Cities Integrated Development Project, Yen Bai Province Sub-project is classified by WB as an environmental-Category B project, which means that most of the impacts are of medium level and controllable. The ESIA report is prepared to assess the impacts caused by the project and propose mitigational measures and management plan for potential impacts and risks in line with the government's environmental regulations and the Bank's CSR policy, they will be implemented as part of ESIA preparation. The final ESIAs will be published on the Bank's and local websites for access by the community prior to the project appraisal.

Policy OP/BP 4.12-Compulsory resettlement [3]

This policy helps mitigate negative impacts of involuntary resettlement and disadvantageous socio-economic impacts; proposes livelihood recovery program to ensure that the affected households (HHs) of the project will have equal or better living conditions than before the

[2] Full version of OP/BP 4.01 can be found at

http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543912~menuPK:1286357~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html

[3] Details of OP/BP 4.12 ca n be found at
http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543978~menuPK:1286647~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html

subproject implementation. This subproject will acquire homestead land, agricultural land of local people and requires resettlement of some households.

Screening of the proposed subproject shows that it would affect 992 HHs, and about 115 HHs have to be relocated. These impacts will cause substantial social risks such as loss of income and livelihood and disrupted social bonds due to loss of land and/or relocation. However, all potential impacts and risks could be predicable, mitigatable and manageable by applying all possible mitigation measures including design alternatives, compensation at replacement cost, provision of land plots in resettlement sites to be constructed within subproject ward/commune for relocated households, and provision of livelihood restoration package for severely and vulnerably affected households. All the potential social impacts and associated mitigation measures have been included in a Resettlement Action Plan (RAP) for implementation. Therefore, the OP/BP 4.12 policy is implemented and specifically mentioned in the RP Project Report of this project.

Policy OP/BP 4.04 - Natural habitats (OP/BP 4.04)[4];

The subproject will be implemented in urban areas and will not involve significant conversion or degradation of critical natural habitats or other natural habitats. However, some civil works will be implemented on existing natural habitats such as dredging of the Nam Cuong ecological lake system. The potential impacts and their associated mitigation measures have been identified and addressed in the subproject ESIA and ESMP.

Policy OP/BP 4.36 - Forest (OP / BP 4.36) [5]

This policy aims to reduce forest destruction: (i) Ensure important forest is not invaded, (ii) Increase the environmental protection of the plantation, (iii) Promote forest plantation, reduce poverty and encourage economic development; (iv) Protect communities' rights to use traditional forests in a sustainable manner, integrate forestry effectively into sustainable economic development, and protect the values of forests.

The project activities and locations of the Yen Bai City Subproject will have an impact on the health and quality of the forest, the rights and interests of the people, and the degree to which they depend on or interact with the forest or changes in it. Manage, protect, or use planted or planted forests. Therefore, this policy is enabled.

Environment, Heath and Safeguard Guidelines of World Bank Group

The sub-projects funded by World Bank will also have to take into account the environmental, healthcare and safety instructions of World Bank Group (called "EHS instructions"). The EHS instructions are technical referential materials with specific examples of International Best Practices.

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[4]Full version of OP/BP 4.04 ca n be found at

http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543920~menuPK:1286576~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html

[5] Bản đầy đủ của OP/BP 4.36 có thể xem tại

https://policies.worldbank.org/sites/ppf3/PPFDocuments/090224b082301a8c.pdf

The EHS guidelines cover the levels and measures adopted by the World Bank Group and are generally considered achievable in new facilities at affordable costs using existing technology. The environmental assessment process may propose alternative levels or measures (lower or higher), which, if acceptable to the World Bank, become subproject or site specific requirements. This subproject is in line with these Guidelines.

World Bank-financed projects should also take into account the World Bank Group Environmental, Health, and Safety Guidelines (known as the "EHS Guidelines"). The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice.

The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group and are generally considered to be achievable in new facilities at reasonable costs by existing technology. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to the World Bank, become project- or site-specific requirements. This subproject should conform to the general EHS Guidelines and industry specific EHS Guidelines on Water and Sanitation.

C. ESIA IMPLEMENTATION

ESIA report for *"Dynamic Cities Integrated Development Project, Yen Bai Province Sub-project"* is assigned by Yen Bai City People's Committee to Yen Bai City Construction and Investment PMU to be in charge of implementation with support by the Consultant being Vietnam Infrastructure Engineering Joint Stock Company (ICON).

Table 2: List of staff participating in preparation of ESIA Report

No.	Full name	Position/ Title	Agency	Mission
1	Cao Kim Thắng	Director	Yen Bai City Construction and Investment PMU	+ Overall direction of the issues related to the design and implementation of the project.
2	Nguyễn Toàn Thắng	Deputy Director	Yen Bai City Construction and Investment PMU	+ Technical assistance and coordination with relevant agencies.
3	Nguyễn Hữu Tuấn	Director	Vietnam Infrastructure Engineering Corporation	+ Overall responsibility + Project management and coordination
4	Nguyễn Nhật Nam	Water supply and drainage specialist	Vietnam Infrastructure Engineering Corrporation	+ Evaluation of technological processes and project effectiveness. + Compilation of component report / reports

No.	Full name	Position/ Title	Agency	Mission
5	Nguyễn Thị Mai Hoa	Master of Environmental Science	Vietnam Infrastructure Engineering Corrporation	+ Assessment of present status and calculation of pollution. + Summarisation of thematic reports and preparation of consolidated reports.
6	Phạm Thị Ngọc Bích	Master of Environment	Vietnam Infrastructure Engineering Corrporation	+ Assessment of present status and calculation of water pollution, CTR. + Write a thematic report.
7	Bùi Ngọc Hà	Bachelor of Social sciences	Vietnam Infrastructure Engineering Corrporation	+ Assessment of the present economic and social situation + Compilation of thematic report.
8	Nguyễn Song Tùng	Master of Environmental Science	Vietnam Infrastructure Engineering Corrporation	+ Socio-economic survey and community consultation + Compilation of thematic report.
9	Lê Thị Thơm	Drainage engineer	Vietnam Infrastructure Engineering Corrporation	+ Assessment of the status and design of processing technology. + Compilation of thematic report.
10	Phạm Hồng Sơn	Drainage engineer	Vietnam Infrastructure Engineering Corrporation	+ Evaluation and identification of risks and incidents during the construction and operation and proposed solutions.
11	Nguyễn Văn Hĩu	Environmental engineer	Institute of Tropical Architecture – University of Architecture	+ Planning, directing, coordinating the status quo survey and sampling; + Compilation of the assessment report of the quality of the background environment.
12	Nguyễn Mạnh Tú	Bachelor of Environment	Institute of Tropical Architecture - University of Architecture	+ Status survey and environmental assessment + Assessment of the quality of the background environment.

No.	Full name	Position/ Title	Agency	Mission
13	Nguyễn Văn Hải	Bachelor of Environment	Institute of Tropical Architecture - University of Architecture	+ Assessment of the quality of the background environment; + Sampling, field measurement and analysis of laboratory parameters.

D. METHODS APPLIED DURING ESIA IMPLEMENTATION

- Site survey method: Investigating, surveying existing environmental resource conditions; Taking soil, water samples, collecting lastest version of materials about the project area; Researching and selecting observation locations, parameters and methods, and taking soil, deposit, surface water, groundwater, air samples within the project area;
- Site sampling and analyzing in laboratory: Surface water samples, groundwater samples, wastewater samples, ambient air, noise, vibration and sediment samples will be collected and analyzed for environmental quality assessments in the subproject area in accordance with the current regulations. Samples are preserved and analyzed at a laboratory meeting the standards required for laboratories qualified for environmental monitoring services by Environment, Climate, Architecture and Energy Research Center.
- Community consultation: The Consultant organized community consultation meetings and group discussions in all areas of subproject construction items, attended by all types of subject: Indirectly, directly individuals/HHs, management agencies, subproject developers, other organizations and individuals, etc. Community consultation is conducted 2 times: (i) 1st time: Determination of impact scope, introduction of the project, preliminary assessment of environmental impacts caused by the project activities, collecting comments on mitigating measures; Determining environmental factors that were not known of before in the project area; (ii) 2nd time: Completion of draft ESIA report: To report and discuss draft ESIA results and collect feedbacks as well as agree on the project's environmental impact assessment results. Benefiting and affected governments and people will give comments on social, environmental issues as well as on the proposed technical options and the mitigation measures, andconstruction methods to be implemented.
- Statistical method: Collecting, processing and analyzing relevant meteorological, hydrological, environmental, socio-economic documents;

- Expert consultancy method: Via formal and informal meetings: Collecting experts' comments about negative environmental impacts, proposals on measures to mitigate negative impacts of the project;
- Matrix method: A matrix board will be established being the comparison of each project activity with each environmental parameter or element to assess the cause-consequence relationship. The matrix method is very helpful for determination of the project's impacts. This is a simple, manageable method that does not require much environmental data, yet can clearly analyze many different actions on the same factor. The environmental matrix method can clearly show the relationship between development and environment.
- Quick assessment method: Using the pollution coefficients of World Health Organization (WHO) to estimate waste volume and forecast pollution;
- Comparison method: Assessing the impacts by comparing them with the codes and standards of soil, water, noise, air quality and other relevant environmental standards;
- Modelling method: Using models to calculate and forecast average contents of pollutants in waste gases and wastewater to assess their impacts on the environment and human being;
- Methods of synthesizing, analyzing and formulating the report: Analyzing and synthesizing the impacts of the project on the components of the natural and socio-economic environment in the project area.

CHAPTER 1. SUBPROJECT DESCRIPTION

1.1. GENERAL INFORMATION

- **Subproject name**: "Dynamic Integrated Cities Development Project, Yen Bai Province Sub-project"
- **Executive agency**:

  Yen Bai Province People's Committee

  Address: Dong Tam Ward, Yen Bai City – Yen Bai Province

  Phone: 0216.3856.689 - 0216.3852.343 Email. yenbai@chinhphu.vn
- **Subproject owner:**

  Yen Bai City People's Committee

  Address: Yen Ninh Ward, Yen Bai City, Yen Bai Province

  Phone: 02163.852.387. Email: ubnd.tp@yenbai.gov.vn
- Client's representative: Yen Bai City Investment and Construction PMU

  Representative: Mr. Cao Kim Thang Title: PMU Director
- Consultant supporting the preparaton of ESIA report: Vietnam Infrastructure Engineering JSC (ICON)

  Director: Mr. Nguyen Huu Tuan

  Address: 15B/53 Hoang Cau, O Cho Dua Ward, Dong Da District, Hanoi City

  Tel: 043 5134500 Fax: 043 5136642

1.2. SUBPROJECT LOCATION

1.2.1. Geographical location

In the transitional area between Northwest, Viet Bac and Northern Midland regions: Yen Bai is located at 21.42^0 N, 104.52^0 E, being the administrative center of Yen Bai Province, with total natural area of 106.74 km^2;

- The north and the east border on Yen Binh District;
- The west and the south border on Tran Yen District;

The city is on the left of Red River, with average elevation of 35m above sea level. The topographic structure consists of riverside alluvial strip and ancient riverbed alluvial plain. Low, round-top mountains/hills, valleys and streams are intertwined with undulating fileds along the river.

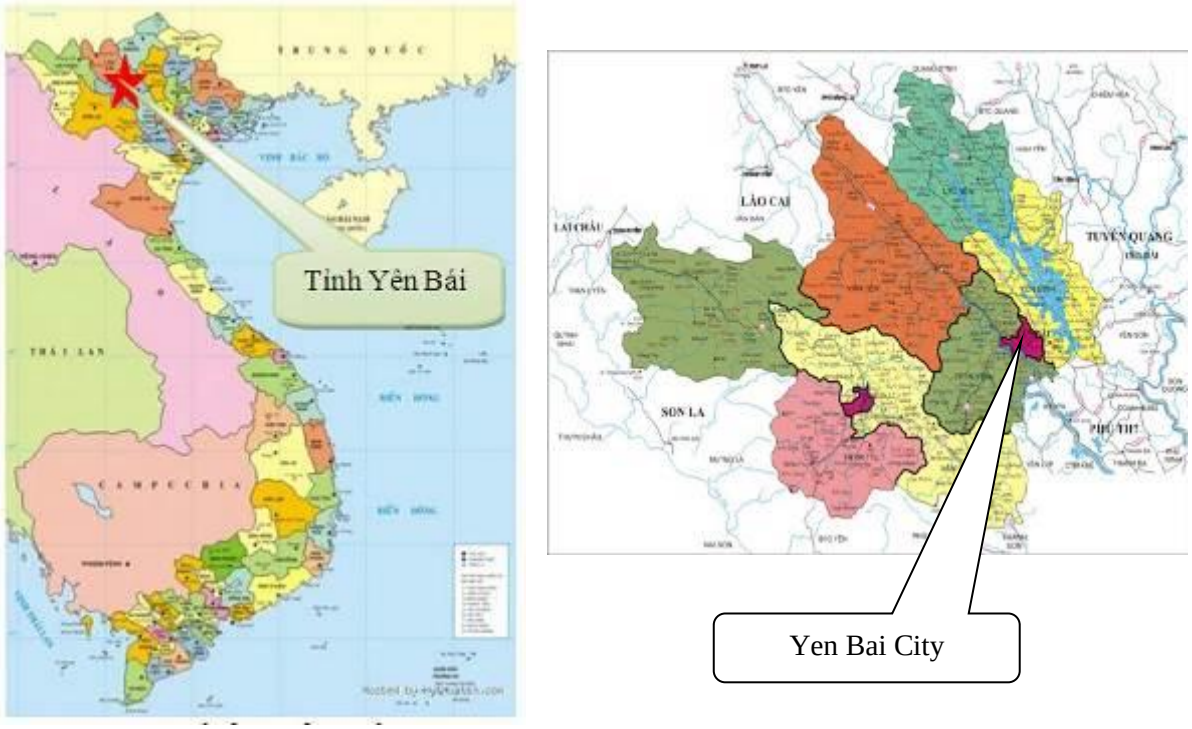


Figure 1: Yen Bai Province and Yen Bai City on the map

1.2.2. The subproject's dynamic role for the region

According to Northern Midland and Mountainous Region Development Plan to 2030, Yen Bai Province is to be (i) a regional dynamic city, (ii) an industrial areas amongst Northern industrial centers, (iii) on national, international tourism routes, and (iv) the provincial-level service center.

Figure 2: Yen Bai City as a dynamic city of the region

(i) Regional dynamism: One of the driving forces for economic development in Yen Bai is the exchange center of the Northern mountainous provinces (Phu Tho, Son La, Lai Chau, Lao Cai, Ha Giang, Tuyen Quang, and Thai Nguyen) which is located on one of the three major economic axes. It is also the gateway that promotes the socio-economic development, trade, tourism, cultural and scientific-technical services in the border region between Vietnam, China and Vietnam - Laos in general, the Northern Midlands and Mountains of Vietnam in particular.

(ii) Industrial zone located in the middle of industrial centers in the North: Large and concentrated industrial zones and clusters, typically three national industrial parks in Yen Bai city and neighboring areas: Minh Quan Industrial Park covers an area of 112 hectares, the Southern industrial zone covers an area of 400 hectares, Au Lau industrial zone 120 hectares; 09 industrial clusters with an area of over 264 ha adjacent to the Noi Bai - Lao Cai expressway, which is favourable for the development of some commodities of the Province's strength to for domestic consumption and export such as Bat Do bamboo shoots, garments and cinnamon oil, etc., enhancing the strengths of raw material areas and providing employment for a number of labors in the Province and neighboring provinces.

(iii) Located on national and international travel routes: Thac Ba Lake Eco-tourism Area; Dam Hau lake ecotourism project invested by Yen Bai Star Golf Company (including 27 holes golf course, resort, eco-tourism ...). Vincom shophouse Yen Bai project invested by the Vingroup, Hoa Sen Yen Bai Hotel, Van Hoi Lake Resort, service areas, warehouses at IC12 intersection of Noi Bai - Lao Cai highway invested by Hoa Sen Steel Group, etc. Given its adjacence to the Noi Bai - Lao Cai highway along with the gradual improvement of infrastructure, Yen Bai city will continue to attract projects and investors to Yen Bai city in particular and other parts of Yen Bai Province in general, improving job opportunities and incomes of local people and promoting the socio-economic development of the Province and the region.

(iv) Yen Bai is also planned as a national service center next to international service centers such as Lang Son and Lao Cai, regional service centers such as Dien Bien, Ha Giang, Tuyen Quang, Cao Bang, Hoa Binh.

1.3. SUB-PROJECT'S INVESTMENT SCALE

1.3.1. Subproject objectives

General objectives:

- Enhancing accessibility to improved urban technical infrastructure services and urban planning and management capacity for the cities;

Specific objectives:

- Addressing the city's challenges; improving the city's service quality (socio-technical infrastructure); enhancing the city's competitiveness and investment appealing;
- Mititgating economic losses due to poor urban infrastructure quality (flooding, traffic congestion, etc.);
- Supporting the city's sustainable development based on improvement of strategic development planning and enhancement of urban management capacity;
- Supporting the city's/province's economic development via comprehensive technical assistance solutions.

1.3.2. Quantity and scale of the subproject work items

The sub-project is to be implemented in 7 wards and communes: 2 communes of Van Phu and Tan Thinh and 5 wards of Nam Cuong, Yen Ninh, Minh Tan, Dong Tam and Yen Thinh.

Work scope:

Structural solution – Improvement and construction of urban technical infrastructure system:

- Sub-component 1: Flood control and urban safety
  - *Rehabilitating Nam Cuong eco-lake no.1 with total area of 19.6ha and total bank length L = 2,365m*
  - *Rehabilitating Nam Cuong eco-lake no.2 with total area of 4.26ha and total bank length L = 850m*
  - *Rehabilitating Nam Cuong eco-lake no.3 with total area of 3.84ha and total bank length L = 1,041m*
  - *Constructing flood control embankment for Cau Dai Stream with total length L = 3,755 m*
  - *Constructing flood control embankment for Hao Gia Stream with total length L = 1,510m*
- Sub-component 2: Development of urban corridor and connectivity enhancement
  - *Road no.1: Constructing road connecting Dien Bien Road to riverside road L = 1,000m*
  - *Road no.2: Constructing road connecting Bach Lam Bridge to Van Phu Bridge (L = 4,678m)*
  - *Road no.3: Constructing road connecting Nguyen Tat Thanh intersection to Au Co intersection (L = 4,200m)*
- Sub-component 3: Resettlement
  - *Resettlement site no.1 in Yen Ninh ward – 1.6ha*
  - *Resettlement site no.2 in Van Phu commune – 0.37ha*
  - *Resettlement site no.3 in Yen Ninh ward – 0.44ha*
  - *Resettlement site no.4 in Yen Ninh ward – 0.40ha*
  - *Resettlement site no.5 in Yen Ninh ward – 0.30ha*

Plan and technical details of the project items are present in Table 3 and Figure 3 hereunder:

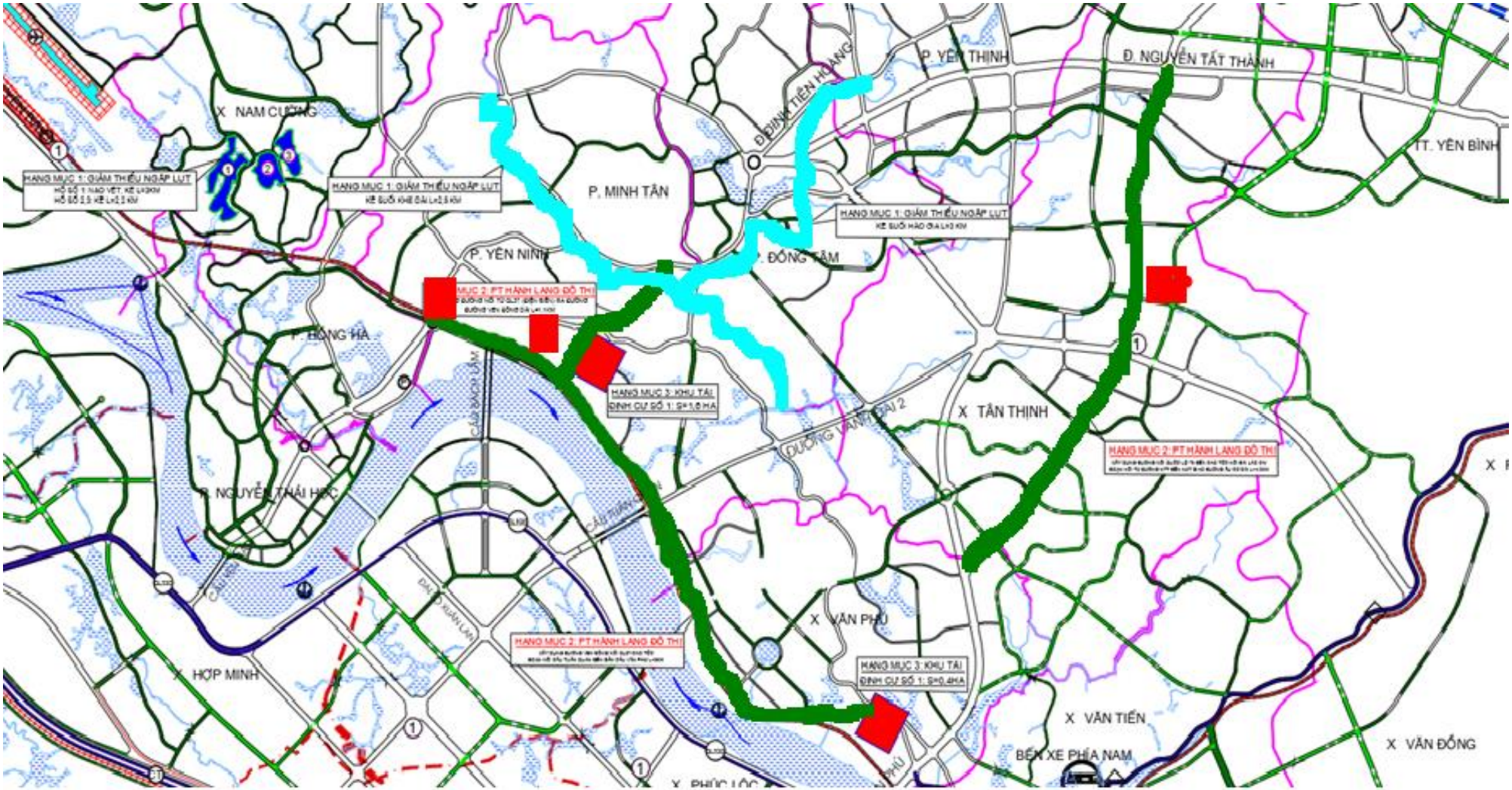


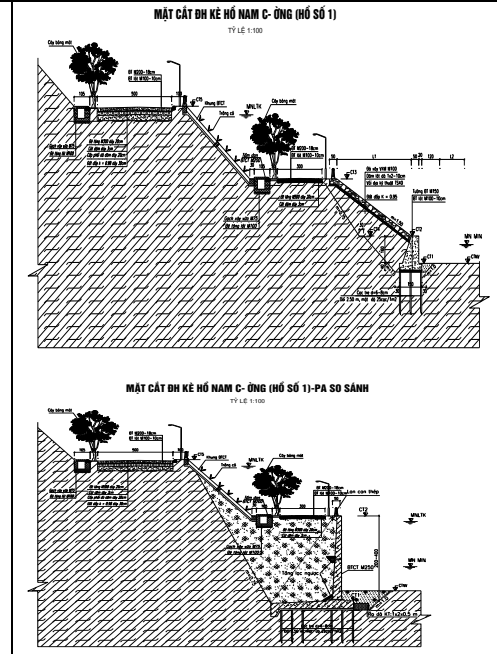
Figure 3: Location of Yen Bai City sub-project's items

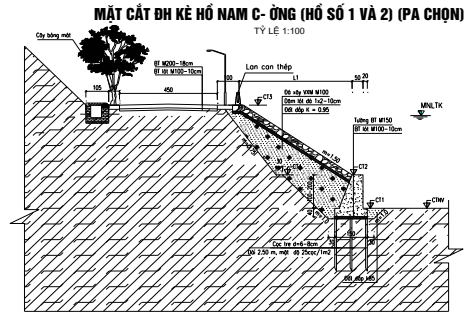
Table 3: Proposed investment items of the sub-project

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
I	**Embankment**				
1	Rehabilitating Nam Cuong eco-lake No. 1: Dredging, constructing soil fall-in control embankment around the lake and other auxiliary works	- Nam Cuong Ward - Existing use: To drain floodwater for the wards of Hong Ha, Nguyen Thai Hoc, Nam Cuong. - Existing technical conditions: • Not embanked yet; soil fall-in • Not dredged yet; severe fill-up - Surrounding concrete road: ~ 2,5m, M200, 18cm, i=2%. - Population: • In some lake sections, people reside along the lake bank. • Main doors of the houses do not face the lake but only the gardens and empty land of the HHs face the lake. Distance to the nearest house is 10 – 200m.	- Area: 19.26ha - Embankmment length: 2,365m - Dredging depth: 0.5m - Vertical wall combined with slope - Embankment foot: M150 gravity concrete wall 2m high - Embankment middle part: applied to class 1 – road with elevation higher than lake surface, concrete M250, 18cm, horizontal slope i=2%, total length 382.14m/total embankment length 2,365m. - Embankment body: Option 1: from top of foot support wall to slope's middle part: placing M200 cement concrete 15cm thick; Option Option 2: RC rib vertical wall - Slope: Grass-growing concrete frame - Embankment top: with combined traffic/operation and management	- Number of directly affected HHs[6]: 12 HHs - Number of indirectly affected HHs[7]: 0 HHs - No displaced, resettled HHs - Total affected land area: 8,401 m^2 • Homestead land: 270 m^2 • Agricultural land: 3,045 m^2 • Land area under management of commune PC: 5,086 m^2	 

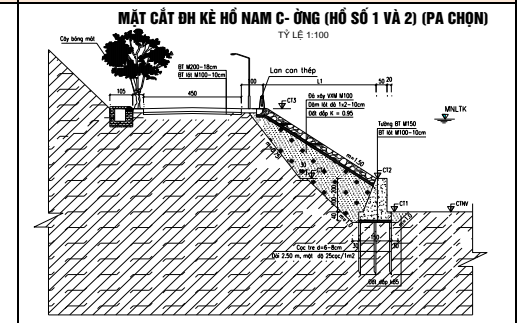
[6] Directly affected HHs: HHs affected by land and crop acquisition by the project

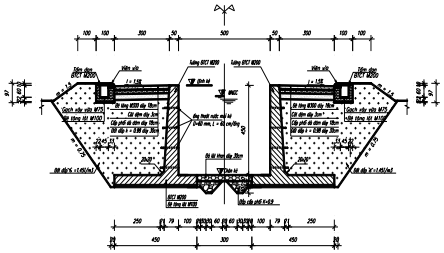
[7] Indirectly affected HHs: HHs affected from practicing cultivation on land under management of commune/town PC

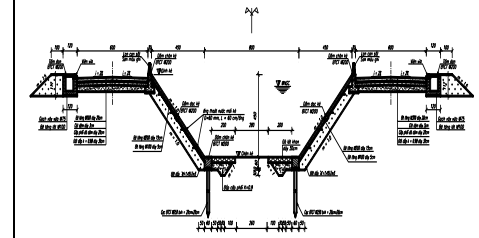
No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
			road: 3.5 - 6.0m, M300 concrete, 20cm, i=2% - Green trees, lighting system along two road sides, rainwater drainage system along the embankment.		
2	Rehabilitating Nam Cuong eco-lake No. 2: Constructing soil fall-in control embankment around the lake	- Location: Nam Cuong Ward - Existing use: Draining floodwater for the wards of Hong Ha, Nguyen Thai Hoc, Nam Cuong - Existing technical conditions: • Not embanked yet; frequently subject to soil fall-in • Concrete road available (2.5m, M200, 18cm, i=2%) as walkway along the lake • The topography of the lake	- Area: 4.26ha - Embankment length: 850m - Embankment food: M150 gravity concrete, 2m high - Embankment body: M200 concrete, 15cm - Embankment slope: M100 cement mortar, 10cm crushed stone, K = 0.95 - Embankment top: With combined road 3.5m wide; M300 concrete structure 20cm thick, i=2%	- No affected or resettled HHs - No affected land area	

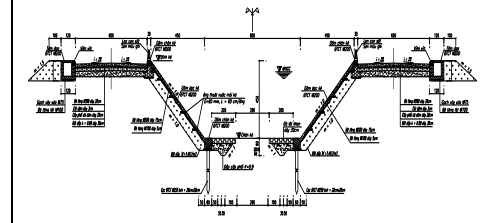
No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
	and other auxiliary works	shore is over 5m higher than the bottom of the lake. - Population: • HHs scatter along lake 1 with main doors facing Tran Binh Trong road, not facing the lake. • In the area adjacent to lake no.3, there is a residential area next to lake no.1, near Son Ca kindergarten and the houses face the lake. Distance to the nearest house is 10-20m.	- Green trees, lighting system and rainwater drainage system along two road sides		 

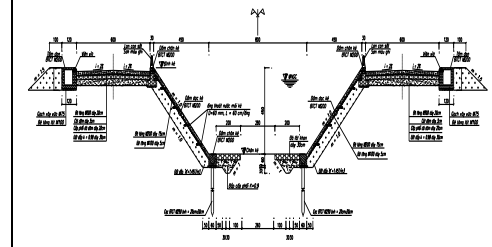
No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
3	Rehabilitating Nam Cuong eco-lake No. 3: Constructing soil fall-in control embankment around the lake and other auxiliary works	- Location: Nam Cuong Ward - Existing use: Draining floodwater for the wards of Hong Ha, Nguyen Thai Hoc, Nam Cuong - Existing technical conditions: • Concrete road available (2.5m, M200, 18cm, i=2%) as walkway along the lake • Not embanked yet; frequently subject to soil fall-in • The topography of the lake shore is over 5m higher than the bottom of the lake. - Population: HHs scatter along the lake, adjacent to Tran Binh Trong Road (next to lake no.2) and adjacent to Le Chan Road with main doors not facing the lake. The community in Cau Den hamlet is adjacent to the riverside concrete road with main doors facing the lake.	- Area: 3,836ha - Embankment length: 1,041 m. - Embankment foot: M150 gravity concrete, 2m high. - Embankment body: M200 concrete, 15cm. - Slope: M100 cement mortar, crushed-stone 10cm, K=0.95 - Embankment top: With combined road: 3,5m, M300 concrete structure 20cm thick; i=2% - Green trees, lighting system and rainwater drainage system along two road sides.	- Directly affected HHs: 36 HHs - Indirectly affected HHs: 2 HHs; - No displaced, resettlement HHs - Total affected land area: 53,308 m2 • Homestead land: 112 m^2 • Agricultural land: 3,296 m^2 • Land area under management of commune PC: 49,900 m^2	 

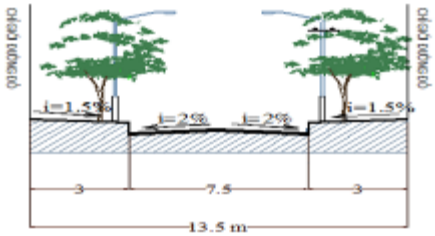
No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
					
4	Constructing flood control embankment for Hao Gia Stream	- Location: • The embankment starts from Km6 market gate to D1 bridge, D1 Road intersecting with Hao Gia Stream • The wards of Dong Tam, Yen Thinh - Existing use: Draining water for the wards of Dong Tam, Yen Ninh, Yen Thinh Commune - Technical conditions: • Many sections already embanked (sections frequently subject to soil fall-in, frequently flooded (1.8 – 3m)) • Total length of embanked sections: 1,350m/2,860m • Subject to fill-up, enroachment, waste disposal causing flow congestion	- Length: L=1,510m, total length of the embankment slopes is 3,020m - Grade of work: grade V - Stability factor: K=1.1 - Design capacity Q=111m3/s - Left road is 6m wide, L=2334m and the right road is 3-6m wide, 1902m long - Stream bed dredging: 7-9m; - Two embankment types: • Passing through residential area: cannot expand construction plan: ~800m • Sections that can be expanded: ~710m. - 6 bridges BxH=3x15.7m are arranged along the embankment, 14 sewers D200, 15cm thick - Ditches B x H = 0,5 x 0.6m, concrete structure R200, reinforced concrete plate M200	- Directly affected HHs: 36 HHs - Indirectly affected HHs: 2 HHs; - No displaced, resettlement HHs - Total affected land area: 53,308 m^2 • Homestead land: 112 m^2 • Agricultural land: 3,296 m^2 • Land area under management of commune PC: 49,900 m^2	 

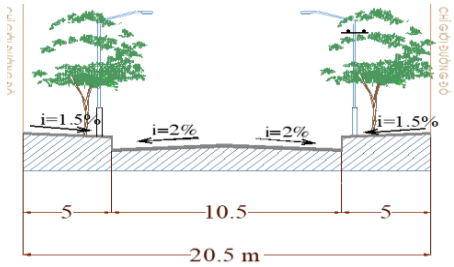
No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
		• Some items such as road-crossing culverts, stream-crossing bridges constructed by the residents themselves have insufficient aperture that limits drainage capacity and causes flooding • Stream bank soil consitions: Soft, causing soil fall-in and threatening life and asset safety of people residing on two sides • Some sections have been embanked, low hills on two sides - Existing reseidence: People reside densely along the stream banks	on top. Wastewater ditches sloping to the catch basin and drain water to the stream via the road-crossing culverts..		
			- Type 1: section crossing densely populated area • M250 RC vertical wall embankment • Embankment wall 4.5m high; body with pressure-reducting drainage holes of flower shape • Embankment top: with road: 3m wide, M300 concrete structure, 20cm, i=2%; layer underneath is Type-1 crushed-stone aggregate K=0,98, 30cm • Road side: M75 mortar-built brick drainage ditch, with M200 RC cover		

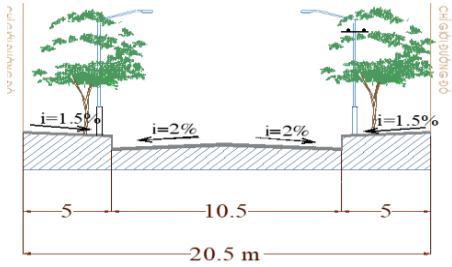
No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
			- Type 2: sparsely populated or unpopulated area • Slope embankment • Embankment foot: M300 RC pile: 20x20, 5m long • Slope: M200 concrete 15cm thick, with lining layer of M100 concrete and slope drainage system of plastic pipe D=5cm • Embankment top: Concrete roads: Left-bank road 6m wide, right-bank 3m wide of M300 concrete structure 20cm thick; Layer underneath is Type-1 crush-stone aggregate, K = 0.98, 30cm • Road sides with drainage ditches, slope of 2%		
5	Constructing flood control embankment for Cau Dai Stream (Khe Dai Stream)	- Location: Minh Tan, Yen Ninh and Dong Tam wards - Existing use: Draining water for the wards of Dong Tam, Yen Ninh, Minh Tan - Technical conditions: • Subject to fill-up, enroachment, waste disposal causing flow congestion • Some items such as road-crossing culverts, stream-crossing bridges constructed by the residents themselves	- Embankment length on each side L=3,55m. - Wall embankment combined with slope - Grade of work: grade V, - Embankment stability factor K=1.1 - Floodwater drainage: $Q_{p2\%}=111m^3/s$ - Frequency P=2% - Corresponding water levek H=33.64m	- Directly affected HHs: 199 HHs - Indirectly affected HHs: 17HHs; - 28 HHs to be relocated and resettled - Total affected land area: 112,994 m2. In which: • Homestead land: 7,567 m^2 • Agricultural land: 82,294 m2, in which, forest production land is 31,344m^2; • Land area under management of commune PC: 10,279 m^2	

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
		have insufficient aperture that limits drainage capacity and causes flooding • Stream bank soil conditions: Soft, causing soil fall-in and threatening life and asset safety of people residing on two sides - Population: • People reside densely along the stream banks (189HHs) • Main doors do not face the lake embankment	- Embankment top elevation 34.09-30.06m, i=1.1‰ - Floodwater drainage canal bottom elevation: 30.49-2700m; i=2.67‰ - 9 civil bridges, each is 15m long; - Left bank road B=3-6m; Right bank road B=6m; - Natural drainage culverts at an interval of 200-300m, combined with manhole to treat domestic watewater before discharge to the streams.		
		- Section 1: • Location: from the intersection of Yen Ninh Road and Kim Dong Road to the converging point with Hao Gia Stream • Technical conditions: already embanked for 750m • Some sections are narrowed because local people build houses, grow crops or build bridge or dispose waste materials. • There is a densely populated area on the left bank but the houses do not face the stream; the sparsely populated area has fruit gardens and forest land.	• Dredging stream bed: 7-9m • Length: 1,880m/2,630m • Slope embankment • Embankment foot: M250 RC piles • Embankment slope: M200 concrete - 15cm, underneath is the M100 concrete layer, with drainage holes in apricot flower shape • Embankment top: Roads on two sides: Roadbed 6m wide, with water collection ditches on two sides • 6 small bridges – each is 15m long and 12 drainage culverts D200-300 along		

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
			the embankment.		
		- Section 2: • From converging point with Hao Gia Stream to intersection with Tuan Quan River • Length of 1,875m • The two banks have not been embanked and no population, there are only some HHs reside at Km5 in the direction towards the pottery factory.	• Dredging stream bed ~ 15m • Slope embankment • Embankment foot: M250 RC piles, M200 beams • Slope: M200 RC 15cm thick, with M100 concrete layer underneath • Embankment top: Road on two sides, 6m wide; M300 concrete structure – 20cm thick, i=2%, underneath is the crushed-stone aggregate layer class 1, 20cm thick, soil embankment layer k=0.98, 30cm thick, 120x120, M75 mortar-built brick drainage ditch, with M200 RC cover. • 3 small bridges, each is 25m long, 5 drainage culverts D200-300		
II	**Road**				

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
6	Constructing road connecting Dien Bien Road to the road connecting Bach Lam bridge and Van Phu bridge (road no.1)	- Location: The wards of Yen Ninh and Minh Tan - Existing use: • This road connects central area from Dien Bien Road to the road connecting Bach Lam bridge and Van Phu bridge • Being the traffic road for part of the community living on the road intersecting with Dien Bien Road and at the interchange with the road to Bao Luong; - Existing technical conditions: • This is an earth road, 3-7m wide; • Mostly low hills and mountains - Population: sparse population, mostly concentrated on the road intersecting with Dien Bien Road and at the interchange with the road to Bao Luong - Distance from the nearest residential area is 5-10m.	- Length: 1,035m - Width: 10.5m; sidewalk: 2x5=10m; total pavement width: 20.5m - Asphalt concrete pavement structure: compact - 12.5 – 5cm and rough - 19 – 7cm, on crushed-stone aggregate foundation of 25mm - 18cm and 37.5mm - 18cm - Drainage: Round culvert, box culvert and slab convert; Beam bridge L=24m: 1 bridge; Round culvert D150: 4 culverts - Design load: H30 - XB80 - Sidewalk: Interlocking block B = 2x5m, i=1% towards roadbed - Curb of M200 cement concrete; M200 RC trench cover (100x100x8cm) - Proper lighting system	- Directly affected HHs: 47 HHs - Indirectly affected HHs: 0 HH; - 11 HHs to be relocated and resettled; - Total affected land area: 18.319 m^2: • Homestead land: 2,758 m^2 • Agricultural land: 11,196 m2, including 9,923m^2 of forest production land; • Land under commune PC's management: 4,635 m2	  

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
7	Constructing road from Bach Lam Bridge to Van Phu Bridge (road no.2)	- Location: Yen Ninh ward and Van Phu commune - Existing use: Connecting the residential area with the road connecting NR 37, NB-LC highway, Van Phu Bridge, Tuan Quan Bridge, Bach Lam Bridge and Van Tien commune - Existing technical conditions: • This is a new road, with mostly low hills and mountains intertwined with residential areas; • Some sections are earth road, no road or intersection with the existing earth road is available in some sections. - Population: sparse; - Distance from the nearest residential area is about 5 - 10m.	- Length: 4,678m - Scale: 10.5m+2x5m=20.5m - Road pavement horizontal slope: i=2% - Asphalt concrete pavement structure: compact - 12.5 – 5cm and rough - 19 – 7cm, on crushed-stone aggregate foundation of 25mm - 18cm and 37.5mm - 18cm - Drainage: D30-5 culverts; D100-9 culverts; D200-2 culverts; box culvert B=75x75-2 culverts; B100x100-1 culvert; slab culvert Lo=75– 1 culvert - Concrete surface water drainage ditch: M150, 15cm, Lo=80cm - Sidewalk: Interlocking brick: B=2x5m, i=1% - Curb: M200 cement concrete with M200 RC cover - 100x100x8cm - Traffic signs: 41 signs - Design load: HL93.	- Directly affected HHs: 310 HHs - Indirectly affected HHs: 26 HHs; - 44 HHs to be relocated and resettled; - Total affected land area: 268,662m^2, in which: • Homestead land: 12,728 m^2 • Agricultural land: 211,714 m2, including 124,545m^2 of forest production land; • Land area under management of commune PC: 38,507 m^2	  

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
8	Constructing road connecting Nguyen Tat Thanh intersection with Au Co intersection (road no.3)	- Location: Tan Thinh Commune - Existing technical conditions: • Terrain consists of mostly low hills and mountains intertwined with ponds and lakes forming uneven terrain with average height of hill tops of about 50m; • A 3-7m earth road is currently available with no connective road. • Population: Small residential areas scattered along the existing road; • No residence on the remaining sections.	- Length: 4,200m - Scale: 10.5m+2x5m=20.5m - Asphalt concrete pavement structure: compact - 12.5 – 5cm and rough - 19 – 7cm, on crushed-stone aggregate foundation of 25mm - 18cm and 37.5mm - 18cm - Drainage: D150-10 culverts; D200-1 culvert; B300x300-1 culvert; 12m slab bridge – 1 bridge - Concrete surface water drainage ditch: M150, 15cm, Lo=80cm - Sidewalk: Interlocking brick: B=2x5m, i=1% - Curb: M200 cement curb with M200 RC cover - 100x100x8cm	- Directly affected HHs: 136 HHs - Indirectly affected HHs: 5 HHs; - 9 HHs to be relocated and resettled; - Total affected land area: 161,749 m^2, in which: • Homestead land: 6,073 m^2 • Agricultural land: 152,334 m2, including 76,347m^2 of forest production land; • Land area under management of commune PC: 3,342 m^2	  
III	**Resettlement site**				

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
9	Residential site No. 1	- Location: Group 26, Yen Ninh Ward - Existing use: The land is currently the forest production land of households, mostly bushes and mixed wood trees such as acacia, bamboo, etc. - Existing technical condition: 5 – 7m wide earth road available in some sections - Population: No population in the proposed resettlement site no.1 - Resettlement site for items 4, 5, 6.	- Area: 1.6ha - Construction: 64 resettlement lots, 160m^2/lot, (L=8m, B=20m) - định cư 160m2/lô - Entrance road to the resettlement site no.1 is designed with the main specifications as follows: + Embankment width Bembankment = 12.00m. + Pavement width Bpavement = 6.00m. + Sidewalk width Bvh = (3.00mx2) = 6.00m. + Cut slope 1/1.00, fill slope 1/1.5. - Longitudinal ditch with trapezoidal cross section B=1.00m. Pavement structure: cement concrete M300, 18cm thick. 15cm thick aggregate road foundation. - M150 cement concrete drainage ditch, 15cm thick, with covering slab - Greenery, lighting system and water supply are made available, with 1 main pipeline D75, HDPE and 3 branch pipelines D40, HDPE. - Reservation lots are designed for communal house and playground.	- Directly affected HHs: 10 HHs - Indirectly affected HHs: 8 HHs; - No displaced, resettlement HHs - Total affected land area: 16,000m^2 • Homestead land: 0 m^2 • Agricultural land: 12,058 m^2 of forest production land; • Land area under management of commune PC: 3,942 m2	 

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
10	Resettlement site No. 2	- Location: Van Lien Hamlet – Van Phu Commune - Existing use: At present the area is unused flat land area of Van Phu Commune - Existing technical conditions: Road leading to the area is Provicial Road 168, with 1m ditches on two sides - Population: scattered along Provincial Road 168; Distance from the nearest residential area is 15 – 50m - Arranged for HHs on road no.2 – section from Tuan Quan bridge to Van Phu bridge	- Area: About 3652m^2 - Arranged on the hills at the Le Loi T-junction, 100m from the ending point of the road connecting Bach Lam bridge and Van Phu bridge towards Van Phu bridge; - Number of resettlement lots: 15 lots (160m2/1 lot; L=8m, B=20m). Corridor width B=6m - Lighting system and water supply are made available, with 1 main pipeline D75, HDPE and 3 branch pipelines D40, HDPE. - Longitudinal ditch with trapezoidal cross section B=1.00m running around to drain water.	- Directly affected HHs: 9 HHs - Indirectly affected HHs: 3 HHs; - No displaced, resettlement HHs - Total affected land area: 3,652 m^2, in which: • Homestead land: 0m^2 • Agricultural land: 1,420 m^2 • Land area under management of commune PC: 2,054 m^2	 
11	Resettlement site No. 3	- Luong Thinh 3 Hamlet – Tan Thinh Commune - Existing use: garden and forest production land are given to the local people by the Government under the reforestation program. Trees include mostly acacia and other wood trees of low value. - Rural concrete road 3 – 8m wide in the front.	- Area: About 4,406m^2 - Arranged along the left side of the road from Nguyen Tat Thanh intersection to Au Co intersection at Km0+750m. - Number of resettlement lots: 18 lots, 160m2 each (L=8m, B=20m). - Lighting system and water supply are made available, with 1 main	- Directly affected HHs: 7 HHs - Indirectly affected HHs: 11 HHs; - No HHs to be displaced or resettled - Total affected land area: 4,406 m^2 • Homestead land: 0 m^2 • Agricultural land: 2,473 m^2 • Land area under management	

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
		- Population: scattered - Distance from the resettlement area: about 100-300m. - Arranged for resettlement for road no.3 under work item no.8.	pipeline D75, HDPE and 3 branch pipelines D40, HDPE. - Longitudinal ditch with trapezoidal cross section B=1.00m to drain water.	of commune PC: 1,933 m^2	
12	Resettlement site No.4	- Group 6, 7 in Yen Ninh ward - Existing use: garden and forest production land are given to the local people by the Government under the reforestation program. Trees include mostly bamboo, acacia, banana, etc. - Technical conditions: mixed garden, 2m pathway, near Ha Noi – Lao Cai railroad. - Population: scattered. Nearest distance from the resettlement area: about 50m. - Arranged for resettlement for work item no. 7 – section from Bach Lam bridge to Tuan Quan bridge.	- Area: about 3,963 m2 - Arranged along the left side of the road from Bach Lam bridge to Van Phu bridge at km 0+250m. - Number of resettlement lots: 22 lots, 160m2 each (L=8m, B=20m). Corridor width B=6m. - Lighting system and water supply are made available, with 1 main pipeline D75, HDPE and 3 branch pipelines D40, HDPE. - Longitudinal ditch with trapezoidal cross section B=1.00m to drain water.	- Directly affected HHs: 16 HHs - Indirectly affected HHs: 7 HHs - No HHs to be displaced or resettled - Total affected land area: 3,963 m^2. In which: • Homestead land: 473 m^2 • Agricultural land: 2,899 m^2 • Land area under management of commune PC: 591 m^2	 

No.	Items	Description of existing conditions	Specifications	Land acquisition, resettlement	Remarks
13	Resettlement site No.5	- Group 39, Yen Ninh ward - Existing use: garden and forest production land are given to the local people by the Government under the reforestation program. Trees include mostly frui trees, acacia, bushes, etc. of low value. - Technical conditions: mixed garden, 3-8m pathway. - Population: scattered. Distance from the resettlement area: about 100-300m. - Arranged for resettlement for work item no. 7 – section from Bach Lam bridge to Tuan Quan bridge.	- Area: about 0.3015 ha - Arranged along the left side of the road from Bach Lam bridge to Van Phu bridge at Km1+150m. - Number of resettlement lots: 17 lots, 160m2 each (L=8m, B=20m). Corridor width B=6m. - Lighting system and water supply are made available, with 1 main pipeline D50→D75, HDPE and branch pipeline D32→ D66, HDPE or zinc pipeline. - Longitudinal ditch with trapezoidal cross section B=1.00m to drain water.	- Directly affected HHs: 5 HHs - Indirectly affected HHs: 8 HHs - No HHs to be displaced or resettled - Total affected land area: 3,015 m^2. In which: ● Homestead land: Not affected ● Agricultural land: 2,822m^2; ● Land area under management of commune PC: 193 m^2	 

1.3.3. Auxiliary items

1. Camps and workes

Camps are built in the construction site to serve the daily life and convenience of workers and engineers during construction. In particular:

- 13 work items will be arranged in 6 packages.
- 6 camps will be arranged for workers.

Proposed camp on road no. 1

Proposed camp on road no. 2

Proposed camp on road no. 3

Proposed camp on Hao Gia embankment

Proposed camp on NC 1 embankment

Proposed camp on Khe Dai embankment

Figure 4: Some camps are located on the roads and embankments to be constructed

- Camp is 300-600m^2 large.
- Workers and staff engaged in the construction will be provided with accommdation. PMU office, equipment and material warehouse, site cabinets and medical office, material grounds… will also be provided.
- Camps will be built along the road and embankment to be constructed. Most of the project sites are convenient for setting up worker camps.

Figure 5: Some illustrations of Camps and other auxiliary works at the construction site

- The quantities of materials and fuel will be delivered according to the progress of construction on the site. Petrol will not be gathered on the site in the ground levelling stage, and will be kept at a specific location during the construction phase.
- Before commencing the construction of the camp, the Project Owner will ask the contractor to work with the local authority and to obtain an agreement on the use of land for construction site.
- About 15-188 workers will be mobilized at the site depending on the time of construction. Because a large labor force is gathered on the construction site, the Project Owner considers and prioritizes the use of local labor as a requirement in the bidding documents for the construction contractor, e.g., labors aged from 20 to 35, and from 25 to 60 for experienced labors; number of female workers shall not be in execess of 25% and children workers shall not be used.

Table 4: Demands of labourers for the sub-project

No	Items	No. of labourers (persons)
1	Nam Cuong lake 1 embankment	50
2	Nam Cuong lake 2 embankment	25
3	Nam Cuong lake 3 embankment	25
4	Hào Gia stream embankment	56
5	Khe Dai stream embankment	134
6	Road connecting Dien Bien Rd. to road from Bach Lam bridge to Van Phu bridge	72
7	Road from Bach Lam bridge to Van Phu bridge	188
8	Road connecting Nguyen Tat Thanh intersection and Au Co intersection	125
9	Resettlement site no. 1	70
10	Resettlement site no. 2	65
11	Resettlement site no. 3	15
12	Resettlement site no. 4	18
13	Resettlement site no. 5	23

2. Service road

As for the construction of the roads, the Nam Cuong Lake embankment and the resettlement sites in Yen Ninh and Van Phu wards, there are basically available earth road/asphalt road leading to the construction sites in the relevant wards/communes. However, road is unavailable for the embankment of Hao Gia stream and Khe Dai stream, therefore, depending on each section on the route and whether it can be expanded or not, a service road from 3 to 3.5m in width will be built along the embankment with soil, K95 stone aggregate to ensure smooth and safe travel of 5 – 12 ton vehicles. In the case expansion is impossible, the contractor should consider manual transportation and service road construction to ensure the quality, schedule and reasonable costs.

1.4. CONSTRUCTION METHOD

1. Detecting and removing remaining bombs and mines left from war time

Demining is very necessary to ensure life safety for workers and other staff members at site and proper work progress and quality. Client will hire a specialized firm/military unit or a firm under Ministry of Defense to undertake this work. This task will be done first upon construction commencement.

2. Preparation of site plan

Positioning

Measuring, recovering and fixing locations of route centerlines, construction sites, elevation marks along the routes/locations and providing extra marks; additionally checking and measuring cross-sections when necessary.

For deep and short excavation sites, excavation shall be carried out on the entire cross-section and along the horizontal axis of the road centerline. For the moderate thickness of the excavation site, then dig each layer in the longitudinal direction on the entire width of the

excavation. Digging into beds in case of deep excavations. First, excavator digs an open bed along the excavation, then digs laterally to the sides and at the same time taking advantage of the digging beds to drain water and move the land out.

Excavation of weathered layer

The soil is dug up about 50-120cm from the surface, if not utilized, it will be transported to the waste disposal grounds to avoid pollution for the surrounding environment.

Excavation and backfilling

Excavated soil can be used for embankment, so it can be used mechanically to fill the construction site. Stone, wood, and any other inappropriate material encountered when excavated must be removed from the site and shall not be used for backfilling. Pripority should be given to immediately used parts such as campsite and the rest can be filled later.

Some excavated soil may be given to local people who want to use it for building their houses.

The unused and extra quantities shall be delivered to the waste disposal sites which have been agreed on by Yen Ninh, Dong Tam, Nam Cuong wards and Van Phu, Tan Thinh communes and accepted by Yen Bai City People's Committee at Letter No. 1311/CV-UBND dated 02 November 2017.

Execution of any item should be completely finished before the commencement of the next item; Ensuring the irrigation capacity in the construction phase of about 80% of the present capacity.

3. Base reinforcement pile construction

Base reinforcement using concrete piles: Using specialized pile driving machine to drive the piles. Specifically: Reinforcing embankment slope using dry-paved rubbles 30cm thick, with lining crushed stone layer 10cm thick and geotextile in RC frame, or using specific technical solution for each construction area.

4. Construction method for the work items

***For dredging of lakes and streams*:** Using barges and mud buckets to load weathered materials on the barges, gathering them on the lake bank, loading on 5-10 ton trucks and transporting to dumping grounds.

Construction principles:

- As for Nam Cuong lakes, since lake no. 1 is located downstream, it will be embanked first, lakes no. 2 and 3 later.
- The lake bed is dredged first, the slope and road later (as for the embankment construction)

Sequence of embankment construction steps:

- Identifying alignment centerline, establishing monitoring marks.
- Discharging water to lower the lake water elevation down to the dredging elevation +27.80m.
- Subsequent steps are as stated hereunder.

***Embankment**:* Given the soil fall-in prevention requirement, the embankment lines are to be constructed by successive construction method:

+ Step 1: Removing weathered layers manually and transporting the waste to an unused empty land plot near the construction site before transportation to disposal area;

+ Step 2: Constructing surrounding wall manually and using excavator;

+ Step 3: Excavating soil, leveling to create slope's middle part at the elevation of +0.4 ÷ 0.5m;

+ Step 4: Driving two eucalyptus sheet pile lines adjacent to the two rock gabion edges;

+ Step 5: Excavating rock gabion foundation to elevation of -2.10m;

+ Step 6: Constructing bamboo layer between rock gabion and filling soil;

+ Step 7: Rock gabion construction;

+ Step 8: Embankment slope forming soil filling;

+ Step 9: Embankment slope frame construction;

+ Step 10: Tightly laying rocks into embankment slope frame;

+ Step 11: Surrounding wall removal;

+ Step 12: After slope completion, constructing road on embankment top;

+ Step 13: Finishing the remaing works and clearing the site;

RC drainage culverts and drainage system construction

- Step 1: Leveling, creating construction ground; determining culvert laying elevation

- Step 2: Excavating trench to the design drainage culvert and WW drainage culvert elevations; gathering waste at temporary disposal area and periodically transporting it to disposal site

- Step 3: Constructing, installing, assembling culvert joints (pre-casted RC culverts) or assembling formworks, RC slab covers, pouring concrete (RC culverts casted at site)

- Step 4: Installing HDPE D200-300 WW drainage culverts as designed

- Step 5: Reinstatement soil filling as designed

***Road construction*:** Road, bridge construction method consists of steps as follows:

1. Preparation

- Positioning and localizing the works;

- Preparing labor camps and gathering construction materials;

- Mobilizing machineries and equipment;

2. Concrete road construction

- Step 1: Excavating, dredging unsuitable materials

- Step 2: Covering the land surface up to the hardness standard for each design layer

- Step 3: Excavating road foundation for each section's width; installing formworks and pouring cement concrete

- Step 4: Drawing forms => completion

3. Asphal concrete layer construction

- Step 1: Excavating, dredging unsuitable materials
- Step 2: Covering the surface up to the hardness standard for each design layers
- Step 3: Excavating road foundation for each section's width
- Step 4: Spreading and compacting each soil layer; Slapping (Type 2 and Type 1) (road bed) to the standard hardness for the design layers
- Step 5: Drawing forms => completion

***Bridge construction*:** Construction method consists of steps as follows:

- Abutment construction: Leveling the ground, installing pile drilling construction equipment to create holes to stabilize the wall by placing concrete by underwater concrete placing method. Place the pit to the design elevation.

- Terrestrial pillar construction: Leveling the ground, determining the abutment centerline and position of the pile. Dig pits to design elevation, concrete pile head, flat concrete lining, formwork installation, reinforcement for nails, reinforced concrete dam, body cap. Pour concrete and remove pavement, formwork. Fill up to natural altitude and improve the pillar.

- Underwater pillar construction: Determining the centerline and position of the pile, seting positioning piles or building the pedestal; Installating pile driving equipment on floating or pedestal system, driving piles to the design level; Setting the ring of steel piles, excavating the soil within the circle of steel sheet piles, reinforce the nails, pour concrete; Installing pavement and formwork, finishing pillars.

- Bridge's upper part construction: Preparation of beams, gathering materials and machinery. Construction of molding platform/formwork; Install reinforcement for girders and cables for post-tensioning and installation of formwork; Pour and cure concrete; Construction of beam beams and concrete balustrade; Surface waterproofing, asphalt paving, bridging.

Resettlement site construction

- Step 1: Levelling ground and dividing lots. Leveling ground to make construction ground; Determining the construction elevation required with the drainage slope i=0.5%, K=0.9 and cut slop 1/1, fill slope 1/1.5.

- Step 2: Designing road (applied to resettlment site no.1 only). The road is newly built and located within the resettlement site no.1. $B_{embankment}$ = 12m.

- Step 3: Digging hole down to the sewer and drainge culvert position as designed; Cement concrete drainage ditch M150, 15cm thick, with cover.

- Step 4: Installing the domestic water system provided by Yen Bai Water Supply and Construction Joint Stock Company. The system includes 1 main pipeline D75 and 3 branch pipelines D40.

- Step 5: Erecting electric poles on the sidewalk with 01 circuit breaker, anti-thunder equipment and other auxiliary equipment.

- Step 6: Gathering waste at temporary disposal area and periodically transporting it to disposal site.

- Step 7: Clearing site and finishing the works.

5. Construction organization

Construction sites are established specifically for each construction item. Each construction site may consist of all necessary items as follows:

- Working block of site management board; workers' camps; warehouse and camp area;
- Material ground, assembled structures construction and construction equipment area;
- Mechanical equipment gathering, machining and installation area;
- Gathering area for construction machineries and vehicles;
- Construction site drainage ditch system;
- Site consruction roads;
- Traffic signs, warning signs, lighting system and greenery;
- Completing and handing-over the works.

1.5. MACHINERIES, EQUIPMENT AND MANPOWER TO BE INVOLVED

All the equipment and machineries used for construction under the subproject must not be expired registration period and still be in good operationg conditions. The expected machineries and equipment used for construction are as follows:

Table 5: List of tentative machineries and equipment used for construction works

No.	Machineries/equipment	Investment items (as per Table 3)												
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1.	Excavator ≤ 1.25m3	3	1	1	6	10	3	10	10	2	1	1	1	1
2.	Excavator ≤ 0.8m3	1	2	2	8	5	2	5	6	1	1	1	1	1
3.	25T vibration compactor	1	1	1	5	5	2	5	5	1	1	1	1	1
4.	Chain crane (16T)	1	1	1	-	2	1	2	2	1	1		1	1
5.	Truck crane (10T)	-	-	-	2	2	1	2	2	1	-	-	-	-
6.	Self-operation leveller (108 CV)	1	1	1	-	2	1	2	2	-	-	-	-	-
7.	Bulldozer (110CV)	1	1	1	4	10	3	10	10	1	1	1	1	1
8.	Bulldozer (140CV)	1	1	1	-	2	1	2	2	1	1	1	1	1
9.	5T truck	-	-	-	20	20	5	15	10	-	-	-	-	-
10.	7T truck	10	2	2	-	10	3	10	5	8	3	2	3	3

No.	Machineries/equipment	Investment items (as per Table 3)												
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
11.	10T truck	-	-	-	-	5	2	5	10	-	-	-	-	-
12.	12T truck	-	-	-	-	5	2	5	5	-	-	-	-	-
13.	Platform vibrator (1Kw)	1	1	1	2	2	1	2	2	1	1	1	1	1
14.	Needle vibrator (1.5kw)	1	1	1	2	2	1	2	2	1	1	1	1	1
15.	10T roller	1	1	1	5	5	2	5	5	-	-	-	-	-
16.	16T roller	1	1	1	-	5	2	5	5	1	1	1	1	1
17.	25T vibration roller	1	1	1	-	-	-	-	-	1	1	1	1	1
18.	600m3/h diesel air compressor	-	-	-	8	5	2	5	5	-	-	-	-	-
19.	5001 concrete mixer	1	1	1	8	2	1	2	2	-	-	-	-	-
20.	2501 concrete mixer	1	1	1	6	5	2	5	5	1	1	1	1	1
21.	801 mortar mixer	-	-	-	-	-	-	-	-	-	-	-	-	-
22.	Frog vibrator (80kg)	-	-	-	5	5	2	5	5	1	1	1	1	1
23.	23Kw electric welder	1	1	1	5	5	5	10	10	1	1	1	1	1
24.	Watering truck (5Kw)	1	1	1	1	2	1	2	2	1	1	1	1	1

(Source: Feasibility study report, August 2017)

1.6. SOURCES OF MATERIAL

Construction volume of the subproject items and material demand are presented in the table below:

Table 6: The sub-project's key work quantities

Items	Materials/ fuel (unit: ton)								
	Sand	*Rock*	*Iron, steel*	*Welding stick*	*Wood*	*Water (mortar mixing)*	*Cement*	*Petrol/ Oil/ DO/ FO (liter)*	*Total*
1. NC lake 1 embankment	14765	90636	6529	21731	1578	11489	18373	34633	199,734
2. NC lake 2 embankment	1770	21682	12594	6842	560	3622	5668	10424	63,162

Items	**Materials/ fuel (unit: ton)**								
	Sand	*Rock*	*Iron, steel*	*Welding stick*	*Wood*	*Water (mortar mixing)*	*Cement*	*Petrol/ Oil/ DO/ FO (liter)*	*Total*
3. NC lake 3 embankment	1611	19711	11448	7013	509	3293	5153	11398	60,136
4. Hao Gia stream embankment	140903	17121	434	34790	715	1989	8936	203250	241,728
5. Khe Dai stream embankment	59475	3088000	11922	61345	2025	4602	21953	508121	3,757,443
6. Dien Bien Road – riverside road	976	8525	28529	84.6	32.6	1456	69563	320535	429,701
7. Road connecting Tuan Quan Bridge and Van Phu Bridge	2625	22545	83769	250	96	420567	1860799	799502	3,190,153
8. Road connecting Nguyen Tat Thanh intersection and Au Co intersection	3675	31563	117277	321	134	588794	2606119	119303	3,467,186
9. Resettlement site no. 1	662	5,788	6	13	33,477	167	292	268,751	309,156
10. Resettlement site no. 2	0.13	0.27	1.17	0.00	53.00	27.90	43.73	99,446	99,572
11. Resettlement site no. 3	0.07	0.17	0.20	0.00	48.00	17.09	25.97	43,184	43,276
12. Resettlement site no. 4	0.03	0.07	0.11	0.00	37.00	7.28	11.07	23,434	23,490
13. Resettlement site no. 5	0.04	0.11	0.15	0.00	41.00	10.93	16.61	34,430	34,499
Total	**226462**	**3314791**	**273652**	**132389**					

(Source: Feasibility study report, August 2017)

The main building materials used in the construction process include sand, stone, cement and steel. There are also pre-fabricated materials such as concrete blocks and wires, etc., which will be contracted with the sand mining/trading companies in Yen Bai Province. This is expected to help reduce transportation distance from other locations and promote the in-situ supply, local business, trade, service and economic development. Specifically:

- The backfilling borrow pit on the hills adjacent to the site at Km 2+800m on the left of road no. 2 from Bach Lam bridge to Van Phu bridge or the backfilling borrow pit on the hills adjacent to the site, distance <5km.

Stone is sourced from Huong Ly port in Yen Binh district, Yen Bai Province for construction of drainage works, longitudinal ditches, crushed-stone aggregate foundation, etc. And delivered on Van Tien - Hau Bong route and Bao Luong road to beginning points of the

construction works (Cao Lanh interchange, Km5, Bach Lam bridge, Dien Bien road) with distance L=15 km.

- Stone is sourced from Dong Phu borrow pit for execution of the asphalt concrete pavement and the crushed-stone aggregate foundation and delivered to the site on asphalt road. Distance L=18 – 23 Km.

- Excavated soil is re-used for backfilling along the route and is transported by 10-ton trucks with average distance L=500m.

- Materials such as cement, iron, steel, sant, etc. shall be purchased and delivered from Yen Bai city to the site at a distance L≤5km. Testing shall be conducted before these materials are incorporated into the works so as to ensure their conformity to the project's technical specifications in quality and composition. Iron, steel and mechanical assembled compnents shall be purchased and ordered from local and overseas firms in conformity to the project's technical and mechanical-physical specifications. Testing shall be conducted before these materials are incorporated into the works so as to make sure that the technical specifications are compliant with the applicable standards.

- Water for domestic use and construction of the works must be clean water taken from the local sources and tested for the parameters as required by the applicable standards.

Transportation to the construction sites: Construction materials are transported to the site by road with 10-12 ton trucks and some specialized vehicles. In narrow gauge sections, the contractor may flexibly use 5-7ton trucks and / or rudimentary vehicles to travel short distances on the site.

The main routes for transporting construction materials and waste from the construction site are surveyed and mentioned as follows:

Table 7: Key transportation routes and distances to the sub-project

No.	Material	Location	Main transportation route	Distance (km)
A	**Embankment for Nam Cuong lakes 1, 2, 3**			
1	Sand of different types	- Black sand: Yen Bai City - Yellow sand: Yen Bai City	Xuan Lan, Tran Binh Trong roads	- Black sand: ≤1km - Yellow sand: ≤1Km
2	Stone of different types	Huong Ly Harbor stone borrow pit	Yen Binh district → Nguyen Tat Thanh → Yen Ninh → Le Hong Phong → Tran Binh Trong	≤15Km
		Dong Phu stone borrow pit	Van Hoi → Yen Bai bridge → Cao Lanh → Ly Thuong Kiet → Le Hong Phong → Tran Binh Trong	≤18Km
3	Filling soil	Construction site Filling soil borrow pit adjacent to the construction site	Tran Binh Trong	≤0.5Km ≤5Km
B	**Embankment for Hao Gia and Khe Dai streams**			
1	Sand of different types	- Black sand: Yen Bai City - Yellow sand: Yen Bai City	NR 37	- Black sand: 7km - Yellow sand: ≤5Km
2	Stone of different types	Huong Ly Harbor stone borrow pit	Yen Binh district → Nguyen Tat Thanh → Km5 → Dien Bien	≤15Km
		Dong Phu stone borrow pit	Van Hoi → Yên Bái bridge → Cao Lanh → Dien Bien road	≤18Km
3	Filling soil	Construction site Filling soil borrow pit adjacent to the construction site	Tran Binh Trong	≤0.5Km ≤5Km
C	**Dien Bien Road – riverside road, road connecting Bach Lam Bridge and Van Phu Bridge and road connecting Nguyen Tat Thanh intersection and Au Co intersection, Resettlement sites no. 1, 2, 3, 4, 5**			
1	Sand of different types	- Black sand: Yen Bai City - Yellow sand: Yen Bai City	NR 37	- Black sand: 7km - Yellow sand: <5Km
2	Stone of different types	Huong Ly Harbor stone borrow pit	Yen Binh district → Van Tien → Bao Luong road, Tuan Quan streets	≤15Km
		Dong Phu stone borrow pit	Van Hoi → Yen Bai bridge → Cao Lanh →Ho Xuan Huong	≤23Km
3	Filling soil	Construction site Filling soil borrow pit adjacent to the construction site	Road from Bach Lam bridge to Van Phu bridge	≤0.5Km ≤5Km
D	**Other types of materials**			
	Iron, steel of different types	Yen Bai City	NR 37, Tuan Quan bridge, Van Phu – Yen Bai route, ports	<5Km
	Welding sticks	Yen Bai City		<5Km
	Wood of different types	Yen Bai City		<5Km

	Water (mortar mixing)	Yen Bai City		<5Km
	Cemment of different types	Yen Bai City		<5Km

(Source: Surveying on construction material supply sources, August 2017)

Soil, rock, cement and sand for the subproject will be purchased at these borrow pits and material yards. When carrying out the works, the contractor will require the material supplier to submit the environmental protection commitment certificate/ or EIA approval decision for these borrow pits and material yards, etc. and to comply with the environmental protection regulations, which have been certified for these establishments when they come into operation and supply these material. In case of exploiting these borrow pits, the contractor shall present to the Project Owner/PMU the exploitation license and decision approving and EIA report.Environment protection plan for the exploitation thereof. Thus, this ESIA report does not eleborate on the mining activities but only assesses and predicts the environmental impacts that may arise during transportation of the material. Materials are transported to the site on the principle of where to go to limit the number of material yards.

Electricity supply source

- ✓ Power supply to the city is sourced from the national electricity grid from the Yen Bai 220 / 110kv station (2x125MVA). The city currently uses the 22KV power grid. Therefore, grid electricity can be used for construction.
- ✓ To prevent blackout, backup generator must be installed so that in the events of power cut, power is still available for construction of the works, and the work progress will not be disrupted.

Water supply source

- ✓ Water for domestic use and construction of the works must be clean water taken from the local sources and tested for the parameters as required by the applicable standards.
- ✓ Water for construction: Water is mainly used for watering, limiting dust, car wash... The water used is from the Hao Gia, Khe Dai streams and Nam Cuong lakes for the construction site up to the general requirements for the construction of works. Where surface water is not available, local residents' well or well drilled on site may be used.

1.7. DISPOSAL SITES

According to FS report, estimated quantities of waste disposal for each work item of the sub-project are based on:

- Total quantity of excavation of weathered layer and soft soil (a),
- Excavation quantity of excavated soil (b): is the quantity of excavated soil to the design elevation,
- Filling quantity (c): is the quantity of soil used for filling to the design elevation.
- Re-use quantity (d): the excavated soil is re-used for backfilling for the shortfall as against the design elevation along the embankment routes, roads and resettlment sites,
- Supplementation quantity: is the addition of quantity needed for the shortfall of backfilling for which the excavated quantity is inadequate for backfilling.

The disposal quantity (f) shall be calculated as: a + b – d. The additional filling quantity shall be mentioned in the sections regarding number of transportation times in Chapter 3.

The volume of wastes generated for transportation is shown in the following table:

Table 8: Quantities to be transported and disposed under the sub-project

Items	Excation of unsuitable materials (tons) -a	Excavation quantity (tons) - b	Filling quantity (tons) - c	Re-use quantity (tons) - d	Supplementation quantity (tons) - e	Disposal quantity (tons) - f
Nam Cuong Lake 1 embankment	27.630	235	27.831	235	27.596	27.630
Nam Cuong Lake 2 embankment	22.351	190	22.469	190	22.278	22.351
Nam Cuong Lake 3 embankment	65.854	560	66.381	560	65.820	65.854
Hao Gia Stream embankment	10.434	90060	78658	36024	0	69036
Khe Dai Stream embankment	6.253	189952	193264	77306	0	116771
Dien Bien Road – Riverside road	12.107	422.172	31.957	31.957	0	390.216
Road connecting Bach Lam bridge – Van Phu bridge	14.425	263.870	315.202	148.164	167.037	115.706
Road connecting Nguyen Tat Thanh intersection and Au Co intersection	12.583	369.418	441.283	148.164	233.852	115.706
Resettlement site No. 1	2,153	659,461	46,174	46,174	0	613,287
Resettlement site No. 2	957	107,236	71	71	-	107,165
Resettlement site No. 3	895	57,662	-	-	0	57,662
Resettlement site No. 4	524	23,839	14,046	14,046	0	9,793
Resettlement site No. 5	631	38,085	2,783	2,783	0	35,302

Yen Bai City People's Committee has instructed Yen Bai City Investment and Construction Management Unit and the design consultant and the local authorities to survey the local disposal sites in service of the Dynamic Cities Integrated Development Project.

Temporary disposal sites: temporary disposal sites for the construction period are proposed to be located along the lakes, embankment routes and roads and shall be transported to temporary disposal sites on a daily basis by service roads in a distance less than 500m. These sites are located in the areas acquired for construction of the sub-project's work items.

The proposed temporary disposal sites for the construction materials under the sub-project are as follows:

(i) Location 1: plot 104, along lake 1. Area: about 5,614m2, capacity: about 20,000m^3

(ii) Location 2: plot 83, along lake 1. Area: about 4,817m2, capacity: about 15,000m^3

(iii) Location 3: plot 97, along lake 2. Area: about 1,650m2, capacity: about 5,000m^3

(iv) Location 4: plot 81, along lake 3. Area: about 200m2, capacity: about 350m^3.

(v) Location 5: at pile T128 on the left of the route. Area of 1,912m2, capacity of 6,000m^3.

(vi) Location 6: at pile T128 on the left of the route. Area of 1,868m2, capacity 7,600 m^3.

(vii) Location 7: at pile on the right of the route. Area of 2,407m2, capacity of 28,500m^3.

(viii) Location 8: pile at T145 on the left of the route. Area of 8,947m2, capacity of 33,700m^3.

(ix) Location 9: at pile T160 on the right of the route. Area of about 10,586m2, capacity of 82,000m3.

(x) Location 10: on Bao Luong in hamlet 2 –Van Phu commune. Area is about 1ha. Capacity is 100,000m^3, distance form the construction site to the disposal site is 200m.

(xi) Location 11: at the end of route no. 2, hamlet 5 – Van Phu commune. Area is 2.6ha, capacity is 125,000m^3. Distance form the construction site to the disposal site is 750m.

(xii) Location 12: at Km 1+900 on the left of the route. Area of about 0.3ha, capacity of about 42,500m^3.

(xiii) Location 13: at Km 3+00 on the left of the route. Area of 0.8ha, capacity of abour 65,100m^3.

(xiv) Location 14: at Km 3+400 on the left of the route. Area of 0.4ha, capacity of about 65,000m^3.

(xv) Location 15: at Km 3+800 on the left of the route. Area of 4.6ha, capacity of about 526,000m^3.

Disposal sites:

The dredged sludged at lake 1, upon local consultation and based on the latest environmental monitoring results of deposit quality, may be used as input meterial for Xuan Lan Brick Factory – Nam Cuong ward as it is not polluted with heavy metals, or may be used by local people for growing trees or heightening low-lying fields. The soil and stone excavated shall be used in part for backfilling, some may be given to local people for building their houses and the rest shall be transported to disposal sites. Diposal sites have been surveyed for capacity as responsive to the surplus soil and stone storage demand of the sub-project and approved by the city People's Committee at Letter no. 1311/CV-UBND dated 02 November 2017 for the disposal site of Van Tien under the management of Nam Thanh Energy and Environment Co.,Ltd. Upon consultation with local people and authorities, some disposal sites for sludge are proposed as follows:

(i) Location a: Da Den area: in Dong Phu residential quarter in an area of 0.8ha. Capacity: 24,000m^3

(ii) Location b: Dam Benh, plot 41, map sheets no. 6 + 7. Area: about 0.9ha in residential quarter Cuong Bac. Capacity: about 50,000m^3.

(iii) Location c: Tran Tap area, plot 376, map sheet no. 19. Area: about 0.5ha/ total area of 1.5ha. Capacity: about 30,000m^3.

(iv) Location d: Mr. Vo Thanh's low-lying land plot no. 1 + 4 in residential quarter Cuong Bac. Area: about 0,3 ha. Capacity: about 30,000m^3.

(v) Location e: Ngoi Sen hamlet, Van Phu commune. Area: 60ha. Capacity: about 5,500,000m^3.

Specific routes and distances of the diposal sites under the sub-project are as follows:

Table 9: Routes and distances to the sub-project's disposal sites

No.	Disposal site	Location/Description	Main transportation route	Distance (km)
	Temporary disposal sites			
A	**Nam Cuong lakes 1,2,3 embankment**			
1	Temporary disposal site	Nam Cuong ward	Internal construction rd	≤1km
		Lo. 1: plot 104, along lake 1.	Internal construction rd	≤0.5km
		Lo. 2: plot 83, along lake 1	Internal construction rd	≤0.5km
		Lo. 3: plot 97, along lake 2	Internal construction rd	≤0.5km
		Lo. 4: plot 81, along lake 3	Internal construction rd	≤0.5km
B	**Hao Gia and Khe Dai stream embankment**			
1	Temporary disposal site	Yen Ninh, Minh Tan, Dong Tam wards		
2	Disposal site	Location 5: at pile T128 on the left of the route.	Internal construction road	~0.5Km
		Location 6: at pile T128 on the left of the route.	Internal construction road	~0.5Km
		Location 7: at pile on the right of the route.	Internal construction road	~0.5Km
		Location 8: pile at T145 on the left of the route.	Internal construction road	~0.5Km
		Location 9: at pile T160 on the right of the route.	Internal construction road	~0.5Km
C	**Dien Bien road – riverside road, resettlement sites no. 1, 4, 5; road connecting Bach Lam Bridge – Van Phu Bridge and resettlement site no. 2**			
1	Temporary disposal site	Van Phu commune, Yen Ninh ward		
2	Disposal site	Van Phu commune		
		Location 10: on Bao Luong in hamlet 2 –Van Phu commune.	Yen Bai road to Van Tien commune	< 1Km
		Location 11: at the end of route no. 2, hamlet 5 – Van Phu commune.	Yen Bai road to Van Tien commune	< 1Km
D	**Road connecting Nguyen Tat Thanh intersection and Au Co intersection, resettlement site no. 3**			
1	Temporary disposal site	Tan Thinh commune		
2	Disposal site	Location12: at Km 1+900 on the left of the route.	Internal construction road	<0.5km
		Location 13: at Km 3+00 on the left of the route.	Internal construction road	<0.5km
		Location 14: at Km 3+400 on the left of the route.	Internal construction road	<0.5km
		Location 15: at Km 3+800 on the left of the route.	Internal construction road	<0.5km
	Construction waste disposal sites			
A	**Nam Cuong lakes 1,2,3 embankment**			
	Disposal sites	Location a: Da Den area	Tran Binh Trong → inter-commune/ward concrete road → disposal site	≤3km

		Location b: Dam Benh are	Tran Binh Trong → inter-commune/ward concrete road → disposal site	≤3.5km
		Location c: Tran Tap area.	Tran Binh Trong → inter-commune/ward concrete road → disposal site	≤1km
		Location d: Mr. Vo Thanh's low-lying land plot	Tran Binh Trong → inter-commune/ward concrete road → disposal site	≤4km
B	**Hao Gia, Khe Dai stream embankment, roads no. 1,2,3, resettlement sites no. 1→ 5**			
	Disposal site	Location e: Disposal site in Van Tien commune	Construction site → road → Tran Binh Trong, Yen Ninh, Km5, Yen Bai, Van Phu → Van Tien	≤15km

(*Source: Minutes of agreement on waste disposal sites in the sub-project area, 2017)*

1.8. SUBPROJECT SCHEDULE

Construction, acceptance and hand-over of the works from 2019 to 2022

Table 10: Yen Bai City Sub-project schedule

No.	Task	Completion date
1	PM to approve subproject proposal	Mar 2017
2	Pre-FS report to be submitted to relevant central ministries, agencies	Aug 2017
3	Pre-FS Report to be approved	Nov 2017
4	FS Report to be submitted	Dec 2017
5	FS Report to be approved	Dec 2017
6	Environmental, resettlement reports to be approved	Dec 2017
7	WB to appraise the subproject	Dec 2017
8	Negotiation	Feb 2018
9	WB to approve the subproject	Mar 2018
10	Agreement signing	Jun 2018
12	Construction	Jan 2019 – Dec 2022
13	Acceptance, test running	Jan 2023

(Source: FS Report, 2017)

1.9. INVESTMENT FUND

Total investment of the project is about **58.59 million USD**, equivalent to 1,318,339 million dong (Exchange rate: 1 USD = 22,500 VND):

- Fund from International Bank for Reconstruction and Development (IBRD): **50 million USD,** equivalent to 1,125,000 million dong
- Counterpart fund: **8.59 million USD,** equivalent to about 193,339 million dong

1.10. SUBPROJECT IMPLEMENTATION ORGANIZATION

Executive agency: Yen Bai Province People's Committee

Subroject Owner (Client): Yen Bai City People's Committee

Client's representative: Yen Bai City Construction and Investment Management Unit

Donor: World Bank (WB)

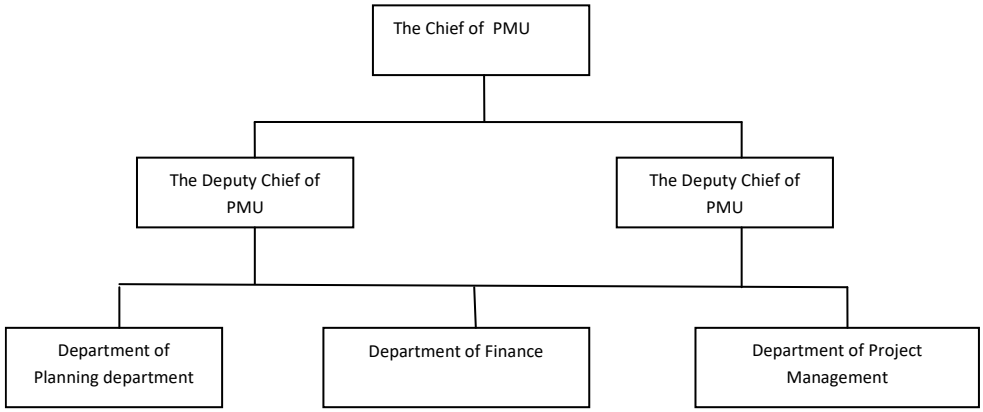


Figure 6: Organisation chart of the Sub-project Management Unit

CHAPTER 2. NATURAL AND SOCIO-ECONOMIC CONDITIONS OF THE SUBPROJECT AREA

2.1. NATURAL CONDITIONS

2.1.1. Topography

The sub-project area has natural terrain with average altitude of 50 - 75m above sea level with 3 main terrain types: Topographic elevation of the Red River alluvium; The topography of the hill is equal to that of the flat top, ribs are smooth, with absolute altitude of less than 300m; valleys in alternation with hills.

Besides, the city's terrain is also featured by middlestream low hills, mountainous areas of Chay River, with valleys of Chay River expanding towards downstream and the reverse-bowl, round top hill range in alternation with narrow riverside alluvial strips.

2.1.2. Geology

Most of the rock base of Yen Bai Province is terrigen sediment of gravel, gritter, sand, powder, clay stone and magma formations. The surface layers are normally only 0.3 ÷ 2m, with some locations of only 0.1 ÷ 0.3m. The rock base layer underneath is cracky and therefore has high permeability and poor water retaining capacity. For long-time cultivation areas, the cracks are filled with soil and therefore have lower water permeability. According to the geologic surveying results of the project areas conducted by Vietnam Infrastructure Engineering Corporation, the geologic characteristics of plain, mountainous areas are as follows:

(*) Nam Cuong lake 1 embankment:

- Layer 2: Clay phase gray, yellowish gray, soft plastic state. 2.3÷14.0m;
- Layer 3: The clay is grayish brown, reddish brown, crushed, hard plastic. 2.3÷14.0m
- Layer 4: Clay is grayish brown, reddish and crushed, semi-rigid. 9.8÷14.0m

(*) Nam Cuong lake 2 embankment:

- Layer 2: Gray, yellowish gray clay, soft plastic state. 2.0÷8.0m;
- Layer 3: The clay is grayish brown, reddish brown, crushed, hard plastic. 2.0÷10.0m
- Layer 4: Clay is grayish brown, reddish and crushed, semi-rigid. 5.8÷14.0m

(*)Nam Cuong lake 3 embankment:

- Layer 2: Clay phase gray, yellowish gray, soft plastic state 1.8÷14.0m;
- Layer 3: The clay is grayish brown, reddish brown, crushed, hard plastic. 1.8÷8.0m
- Layer 4: Clay is grayish brown, reddish and crushed, semi-rigid. 7.8÷14.0m.

(*) Hao Gia stream embankment, road from Dien Bien road to the road connecting Bach Lam bridge and Van Phu bridge, the road connecting Bach Lam bridge and Van Phu bridge and resettlement sites no.1, 2, 4, 5:

- Layer 2: Covered soil: Gray clay, grayish gray, white spots, mixed with construction materials and grit, hard plastic, texture not tight.
- Layer 3: Sandy soil mixed with dark gray, light gray plastic soft state. The composition of the layer is mainly fine sand and dust, an alluvial product of the newly created river.
- Layer 4: The clayey soil is heavy to lightning, and the crushed stone and crushed shale is not entirely dark yellow. The gravel content is about 5 ~ 7%.

(*) Khe Dai stream embankment:

- DD layer: The clay is brownish-gray with roots, 0.3 ÷ 1.8m
- Layer 1: Gray, dark gray clay, soft plastic, 3.7 ÷ 6.3m
- Layer 3: Yellow gray and gray clay, hard plastic state, 1.6 ÷ 9.9m
- Layer 4: Gray and yellow gray clay, semi-rigid to hard. 2.2 ÷ 8.3m
- Layer 5: Strongly altered granite, block structure, granular structure, drums get in the form of chips, 3.3 ÷ 7.6m
- Layer 6: Gray yellow granite in blocks. Altered rocks cracking and drilling in the form of a stick 3.3 ÷ 3.5m.

(*) Road from Nguyen Tat Thanh intersection to Au Co intersection, resettlement site no. 3:

- Layer 1: soil mixed with grits.
- Layer 2: Black, greenish gray clay, soft plastic state, 0.3m.
- Layer 3: Black, greenish gray clay, 0.3 – 0.7m.

2.1.3. Meteorology, climate

Temperature: The project area's 2016 average temperature is about 23.8^{0}C, with highest temperature of about 29.8^{o}C in July and lowest temperature of about 15.8^{o}C in February. The 2012 – 2016 monthly average temperatures and annual average temperature variations measured by Yen Bai City are shown in the table below:

Table 5: Monthly average temperatures measured by Yen Bai Station

Year	Monthly average air temperature (^{0}C)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avr**
2012	14,5	15,6	20,1	25,5	27,8	28,6	28,3	28,0	25,9	25,0	21,8	17,6	**23,2**
2013	14,5	19,1	23,5	24,2	27,6	28,4	27,5	27,7	26,2	23,3	21,6	14,8	**23,2**
2014	15,8	16,6	19,6	24,5	28,2	28,7	28,5	28,0	27,8	25,1	21,8	16,1	**23,4**
2015	17	18,8	21,5	24,3	29,4	29,5	29,3	28,5	27,9	25,5	23,4	17,4	**24,4**
2016	16,5	15,8	19,5	25,1	27,5	29,8	28,9	28,3	27,7	26,2	21,6	19,1	**23,8**

(Source: Yen Bai Province's 2016 Statistical Yearbook)

Air humidity: In the project area, 2016 average relative humidity is 86%. Highest humidity (January, April) is about 90% and lowest humidity (February) is about 81%. From-year-to-year humidity variation is not great (1 - 2%), shown in the table below:

Table 6: Monthly average relative humidity values measured by Yen Bai Station (%)

Year	Monthly average air humidity values over the years (%)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avr**
2012	90	89	85	84	85	87	87	86	89	87	90	89	**87**

Year	Monthly average air humidity values over the years (%)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avr**
2013	93	91	85	86	85	82	88	86	88	85	85	83	**86**
2014	84	89	94	93	82	85	85	87	89	87	90	86	**88**
2015	88	89	93	95	84	84	82	86	87	84	88	90	**87**
2016	90	81	89	90	86	82	86	87	85	83	88	82	**86**

(Source: Yen Bai Province's 2016 Statistical Yearbook)

Wind: In the sub-project area, Northeast monsoon prevails from December to March. In winter days, fog occurrence in early morning and late afternoon is very popular. In this season, there are some foggy days every year. Southeast monsoon prevails from April to November resulting in coolness and rain. At the beginning of summer (May, June), there are Southwest wind in alternation, resulting in hot weather and low humidity. With an average wind speed of 1.2m/s, dust and gases may dissipate on a large scale within the construction site, increasing the emission of dust and gases, thus reducing the pollution caused by dust and toxic gases.

Sunlight: The project area has high volume of radiation which is evenly distributed. This area has average number of sunny hours of 1,454 hours a year, with the month of least sunlight being March (26 hours) and June with most sunlight (214 hours). Change of sunny hours should be closely watched to work out construction plan and to reduce dust emissions on sunny days. Change of the number of sunny hours over the years is shown in the table below:

Table 7: Average number of sunny hours measured by Yen Bai Station (hours)

Year	Monthly average number of sunny hours over the years (hours)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avr**
2012	13	16	50	118	143	116	188	220	125	127	75	38	**1.229**
2013	11	37	60	83	160	173	125	161	133	146	74	140	**1.303**
2014	104	32	12	19	172	127	178	160	153	157	76	78	**1.268**
2015	81	47	35	14	195	182	168	176	146	167	79	41	**1.331**
2016	43	92	26	77	125	214	184	146	168	161	95	123	**1.454**

(Source: Yen Bai Province's 2016 Statistical Yearbook)

Rainfall: Rainy season in Yen Bai last normally from April to September every year (at its peak in May, July, August) accounting for 80% - 85% of total rainfall of the whole year. In the project area, 2016 rainfall was 1,805.0mm; Highest rainfall was 404.7mm (July) and lowest rainfall was 17.6mm (February). The contractor should base his construction plan on the rainfall, especially days with heaviest rain and rainy season, to minimise the impacts and damage caused by floods. Rainfall variation over the years is shown in table below:

Table 8: Monthly average rainfall measured by Yen Bai Station

Year	Monthly average rainfall over the years (mm)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avr**
2012	60,7	25,0	43,3	55,7	672,0	54,2	386,1	406,1	213,9	73,7	62,3	31,3	**2.084,3**
2013	36,3	50,6	27,9	124,5	118,9	91,0	414,3	262,4	181,7	97,7	7,9	79,7	**1.492,9**
2014	6,1	44,3	71,8	115,6	71,1	150,3	297,8	375,0	351,7	127,9	107,2	20,5	**1.739,3**
2015	93,5	28,0	102,3	115,6	185,3	163,4	182,6	364,7	375,8	90,9	195,8	113,8	**2.011,7**
2016	70,2	17,6	66,0	155,0	355,0	86,7	404,7	353,7	78,5	78,8	83,1	55,7	**1.805,0**

(Source: Yen Bai Province's 2016 Statistical Yearbook)

2.1.4. Hydrology

The city's hydrological regime is relatively diversified thanks to the Red River (Thao River) flowing through the lake, pond, stream system. The Red River section flowing through Yen Bai City has lower flow velocity, wide riverbed of 100 – 200m in width and alluvial grounds. Lowest water level is 2 - 3m (in dry season), and may reach 20 - 30m in rainy season. Red River has special hydrological peculiarities, with abundant water and alluvial reserves. From November to April every year, average flow rate is 2,000m^3/s, and from May to October average flow rate is 4,000 m^3/s. Ships and boats can travel around the year, and ships and motorboats can travel only in about 9 months because of many sandbars.

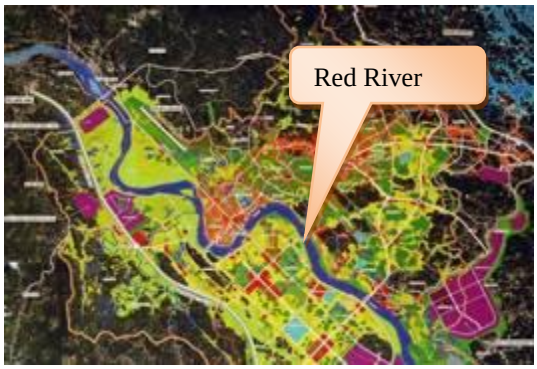


Figure 7: Red River flowing through Yen Bai City

Beside the main water source being Red River, the city also has the key lake, pond, stream system including Hao Gia, Boi streams (Yen Hoa Park lake), Nam Cuong Lake, Hao Gia Stream, Cau Dai Stream that are the natural water resources to help drain water, regulate water distribution, enhance general landscape and increase natural water reserve.

+ *Yen Hoa Lake*: This lake is adjacent to the arterial roads of Nguyen Thai Hoc and Thanh Cong, with total area of over 10ha that stores freshwater, regulate the area's landscape and ecological system, and is also the urban landscape landmark of the city and helps regulate water in the rainy season.

Figure 8: Yen Hoa Lake

+ *Hao Gia Lake*: This is the lake system of the central Km 5 area being a densely populated area and an administrative center of the province. This lake also helps drain surface water for the central area, store water in rainy season, control floods and regulate water for the streams. Besides, it also helps regulate climate and improve environmental landscape. At present, the embankment system of the lake has been severely degrading, affecting the lake's storage and regulation capacity.

Figure 9: Hao Gia stream

+ Nam Cuong eco-lake - reservoir:

Nam Cuong Lake is in Nam Cuong Ward, just 3 kilometers away from the city's centre, with total area of more than 50ha. As planned, this will be developed in to an ecological park with 3 main sections, of which the first zone is about 30ha designed entertainment and recreation activities, consisting of sporting hall, swimming pool, hotel, tennis course, fishing lake. This lake helps drain surface water, supply water for agricultural production, and also helps regulate water for the city. However, at present, the lake bed has been subject to fill-up, and there have not been solid embankment line, with many soil fall-in locations.

Figure 10: Nam Cuong eco-lake

+ Cau Dai Stream:

The beginning point is near the intersection of Yen Ninh and Kim Dong roads. The ending point is Rose Kindergarten, approximately 2.86km long. The stream helpa drain water for the wards of Yen Ninh, Minh Tan and Dong Tam. However, households are encroaching on the stream banks, disposing waste and WW directly into the stream. Some sections do not have have operation and management corridor roads.

Figure 11: Cau Dai stream (Khe Dai stream)

+ Hao Gia Stream:

The beginning point is Nguyen Duc Canh Bridge, and the ending point is Rose Kindergarten alley, with total length of 2,630km. The stream helps to drain water for the wards of Dong Tam, Tan Thinh and Yen Thinh. Currently, houses are built right on the canal banks. Waste and waste water are discharged directly to the canal surface, causing flow congestion. Soil fall-in and fill-up have been causing flow congestion.

Figure 12: Hao Gia stream

Besides, Nguyen Phuc, Hong Ha and Nam Cuong wards also have Yen and Ong streams to drain water for these wards.

Yen Stream: The beginning point is Cuong Do culvert on Le Hong Phong Road; the ending point is Yen Stream towards Red River, about 1.3km long. The stream helps to drain water for the wards of Nguyen Phuc and Hong Ha. Houses scatter along the stream, environment is not polluted and the landscape is not affected.

Figure 13: Ngoi Yen stream

Ong Stream: The beginning point is from the weir of Nam Cuong commune's reservoir and the ending point flows to Thao River via road-crossing culvert on 151 provincial road. This stream is about 1.3km long and helps drain water for Nam Cuong lake and part of Yen Ninh ward and Tuy Loc commune. The environment is pristine and clean. Households scatter along the stream.

Figure 14: Ngoi Ong stream

2.1.5. Existing conditions of the environment

Vietnam Infrastructure Engineering Corporation conducted sampling in the project areas in August 2017. In particular, 14 air samples, 10 surface water samples, 10 underground water samples, 10 wastewater samples, 8 mud samples and 5 sediment samples were taken. These samples were analysed by Environment, Climate and Energy Research Centre – Institute of Tropical Architecture. Sampling map and locations are presented in the Appendix. The analysis results are as follows:

1. Quality of air, noise and vibration

14 air samples were taken at each of the construction sites.

The parameters include Temperature, Humidity, Wind speed, Relative noise, Vibration, TSP (24h), PM_{10}, SO_2, NO_x, CO, HC.

Comparative standards:

- QCVN 05:2013/BTNMT – National technical standard of surrounding air quality;
- QCVN 26:2010/BTNMT: National technical standard of noise;
- QCVN 27:2010/BTNMT: National technical standard of vibration.

Measurements of the existing air environment are shown in the table below.

Table 15: Locations of air sampling

No	Code	Location	Coordinates	
			X	Y
Nam Cuong lakes 1, 2, 3 embankment				
1	KK1	Air at Nam Cuong lake no.1 at the T-juntion of the concrete road to the residential area	2402653	0486896
2	KK2	Air at Nam Cuong lake no.1 at the medical station on Tran Binh Trong road	2402469	0486781
3	KK3	Air in Van Thang pagoda on Nam Cuong lakes 2,3	2402745	0487155
4	KK4	Air near the concrete road, about 2m from Cuong Lo stream – Dong Phu hamlet	2403268	0486580
Khe Dai and Hao Gia stream embankment				
5	KK5	Air at Yen Ninh bridge – Beginning of Khe Dai embankment route	2402930	0487241
6	KK6	Air at Khe Lap bridge, the converging point between Khe Dai and Hao Gia streams	2403002	0487011
7	KK7	Air at the State Treasury, intersection between Nguyen Van Cu road and Nguyen Tat Thanh road – Beginning point of Hao Gia stream embankment route	2402436	0489338
8	KK8	Air at the ending point of Khe Dai stream embankment route – near Bao Luong bridge –Dong Tam ward	2401820	0490401
Roads no. 1, 2, 3 and resettlement sites no. 1,2,3,4,5				
9	KK9	Air at Ms.Nguyen Thi Lan's house – Dien Bien road intersection	2402888	0471982
10	KK10	Air at Bach Lam bridge	2401320	0471634
11	KK11	Air at Tuan Quan bridge	2402066	0489970
12	KK12	Air at Van Phu bridge	2400560	0489768
13	KK13	Air at Nguyen Tat Thanh road intersection	2403414	0413995
14	KK14	Air at Au Co road intersection	2397944	0491779

Analysis results of the air environment in the projec areas are shown in the table below:

Table 9: Quality of the air environment

No	Parameter	Unit	NC lakes no. 1,2,3 emb.			Hao Gia, Khe Dai stream emb.				Roads no. 1,2,3, resettlement sites no. 1,2,3,4,5							QCVN 05:2013 /BTNMT
			KK1	KK2	KK3	KK4	KK5	KK6	KK7	KK8	KK9	KK10	KK11	KK12	KK13	KK14	
1	Temperature	^{0}C	33,6	34,2	33,8	24,1	36,7	30,8	26,8	26,7	28,8	30,2	31,4	27,6	26,8	27,3	-
2	Humidity	%	71,2	70,3	71,5	69,4	68	69,2	80,2	81,3	76,5	64,5	68,5	83,5	86,1	85,2	-
3	Wind speed	m/s	0,29	1,16	0,54	0,38	0,26	0,32	1,03	0,56	0,43	0,62	1,26	0,63	0,58	0,42	-
4	Relative noise	dBA	60,3	61,7	59,2	61,2	68,3	**71,4**	**75,2**	**71,7**	**74,4**	**75,6**	**74,3**	**72,8**	**75,9**	**75,2**	**70(*)**
5	Vibration	dBA	38	41	43	47	52	56	49	52	48	56	62	61	64	63	**75 (**)**
6	TSP (24h)	µg/m3	62,3	65,1	71	68	92	88	40,5	38,1	43	51	58	61	59	63	**200**
7	PM_{10}	µg/m3	31,2	32	36,7	35,1	45	38	26,7	28	31,2	34,1	28,5	30,1	32,6	35,7	**150**
8	SO_2	µg/m3	31,5	38,8	41,5	43	52,3	39	25,5	26,1	28,3	33	40,2	43,5	45,7	48,2	**350**
9	NO_x	µg/m3	32,5	37	43,6	36,5	58,9	47	27,5	28,5	31,7	33,6	32,4	33,8	35,6	36,2	**200**
10	CO	µg/m3	2650	2740	2860	3040	3280	2650	1650	1460	1820	2100	3650	3460	3520	3420	**30 000**
11	HC	µg/m3	358	364	362	371	342	367	983	894	752	631	658	1020	1206	1130	**5 000**

**** Analysis results of air environment quality***

It can be inferred from the table of quality of the air environment that most of the basic parameters meet the standards. The noise levels in the stream embankment sites near the intersection with Nguyen Tat Thanh road, Bao Luong road, roads and residential areas are slightly higher than the allowed level of 1.02 – 1.08 times. At the measuring locations, medium to high traffic volume cause higher noise level than the allowed standard.

- At some monitoring locations, the vibration level is approximately equal to the allowed standard but still within the allowed limits (QCVN 27:2010/BTNMT).

- The amount of suspended dust in the samples ranges from 40.5 to 92 µg/m^3, 2.2 – 4.9 times lower than standards.

- Contents of SO_2, CO, NO_x and HC in the samples are lower than standards. The SO_2 content is 6.5 – 11.1 times lower than the standard; CO content is 8.3 – 20.5 times lower than Vietnam's standard 05:2013/BTNMT; NO_x content is about 3.4 – 7.3 times lower than the allowed limits; HC content is 4.1 – 14.6 times lower than the allowed limits.

Overall comments: Air quality in the project area is good, the monitoring parameters are much lower than the allowed limits. Noise level on the embankment sections crossing the intersections with Nguyen Tat Thanh road, Bao Luong road, roads no. 1, 2, 3 and resettlment sites is 1.02 – 1.08 times higher than the allowed limits.

2. Surface water quality

10 surface water samples were taken at the sub-project's work items.

Monitoring parameters include Temperature, pH, Fertility, TSS, EC, DO, BOD_5, COD, N, NO_2^-, NO_3^-, P, Cl^-, Pb, As, Zn, Fe, Detergent, Total oil, fat, total coliform.

Comparative standard:

- QCVN 08-MT:2015/BTNMT – National technical standard of surface water quality, column B2;

Surface water samples were taken at the sub-project's construction site, specifically shown in the table below:

Table 10: Locations of surface water sampling

No	Code	Location	Coordinates	
			X	Y
Nam Cuong lakes 1, 2, 3 embankment				
1	NM1	Surface water of Nam Cuong lake 1	2402438	04087154
2	NM2	Surface water of Nam Cuong lake 2	2402714	0487097
3	NM3	Surface water of Nam Cuong lake 3	2402745	0487040
Hao Gia and Khe Dai stream embankment				
4	NM4	Surface water at Yen Ninh bridge –Khe Dai stream embankment	2402651	0489339

5	NM5	Surface water at Khe Lap bridge– converging point between Khe Dai and Hao Gia stream embankments	2402005	0490459
Roads no. 1,2,3 and resettlement sites				
6	NM6	Surface water at the bridge on the concrete road to Dien Bien road	2402866	0490862
7	NM7	Surface water on Hao Gia stream	2401272	0413165
8	NM8	Surface water at Bach Lam bridge on Red River	2401206	04884475
9	NM9	Surface water at Tuan Quan bridge on Red River	2400775	0489424
10	NM10	Surface water near Van Phu bridge on Red River	2398068	0491923

Analysis results of surface water quality are shown in the following table.

- pH ranges from 6.83 to7.28, water samples have medium pH within the allowed limits; suspended solid contained in water samples is not high, 1.1 – 1.7 times lower than the allowed limits.

- DO content in the samples is within the allowed limits, ranging from 3.48 to 5.26 mg/l.

- BOD5 in the water samples ranges from 7.09 – 13.69 mg/l, which is 1.8 – 3.5 times lower than the allowed limits, COD values measured at the monitoring locations are much lower than the allowed limits (1.7 – 3.6 times).

- Heavy metal contents in the water: Pb ranges from 0.0031-0.0092mg/l, As from 0.001 to 0.0068mg/l; Zn from 0.32 to 0.96 mg/l; Fe from 0.42 to 0.94 mg/l. In general, the heavy metal contents in the samples taken in all the monitoring locations are much lower than the allowed limits.

- Oil content in all the samples is within the allowed limits (2.8-17.2 times lower than QCVN 08-MT:2015/BTNMT).

- Detergent content measured in all the monitoring locations is 1.6 – 12.5 times lower than the allowed limits.

- Total Coliform in the water samples ranges from 1600 to 5300 MPN/100ml, 1.9 – 6.3 times lower than QCVN 08-MT:2015/BTNMT.

Overall comments: The surface water monitoring parameters fall within the allowed limits. It is concluded that the surface water quality in the sub-project area is good.

Results of surface water quality analysis are shown in the table below:

Table 11: Results of surface water quality analysis

No	Parameter	Unit	NC lakes 1,2,3 emb.			Hao Gia, Khe Dai stream emb.		Roads no. 1,2,3 and resettlement sites					QCVN 08-MT: 2015, column B2
			NM1	NM2	NM3	NM4	NM5	NM6	NM7	NM8	NM9	NM10	
1	Temperature	^{0}C	29,6	29,5	28,9	28,7	26,8	27,3	26,9	27,5	28,6	27,4	-
2	pH	-	7,25	7,11	7,15	6,83	6,96	7,01	7,02	7,21	7,28	7,06	**5,5-9**
3	Fertility	Pt-Co	0,6	0,4	0,5	0,83	0,89	0,96	0,86	2,89	2,65	2,83	-
4	TSS	mg/l	60,1	62,3	61,3	70,1	72,1	71,5	72,5	89,1	90,1	87,5	**100**
5	EC	mS/cm	235	221	226	231	238	245	235	312	324	318	-
6	DO	mg/l	5,13	5,26	5,28	4,58	4,52	4,51	4,65	3,46	3,48	3,54	**≥2**
7	BOD_5	mg/l	8,1	7,09	7,13	10,6	11,2	11,8	11,8	13,69	13,58	12,98	**25**
8	COD	mg/l	13,9	14,2	14,6	17,5	16,4	18,3	16,2	28,5	29,1	28,3	**50**
9	T-N	mg/l	3,06	3,08	3,1	4,28	4,16	4,35	4,12	6,3	6,5	6,38	-
10	NO_2^-	mg/l	0,003	0,004	0,006	0,0068	0,0082	0,0086	0,0086	0,0091	0,0095	0,0089	**0,05**
11	NO_3^-	mg/l	3,93	4,06	4,12	5,02	5,16	5,28	5,13	6,25	6,13	6,18	**15**
12	T-P	mg/l	1,13	1,18	1,26	1,25	1,36	1,09	1,32	3,62	3,58	3,75	-
13	Cl^-	mg/l	168	172	176	196	206	201	201	263	267	268	-
14	Pb^{2+}	mg/l	0,0032	0,0031	0,0028	0,008	0,0065	0,0073	0,0092	0,0098	0,0091	0,0096	**0,05**
15	As^{2+}	mg/l	0,001	0,002	0,001	0,004	0,0036	0,0048	0,028	0,056	0,063	0,072	**0,1**
16	Zn^{2+}	mg/l	0,36	0,32	0,38	0,42	0,48	0,56	0,43	0,96	0,93	0,88	**2**
17	Fe^{2+}	mg/l	0,43	0,42	0,47	0,56	0,64	0,68	0,62	0,89	0,92	0,94	**2**
18	Detergent	mg/l	0,06	0,04	0,08	0,08	0,072	0,06	0,073	0,32	0,26	0,28	**0,5**
19	Total oil, fat	mg/l	0,058	0,062	0,064	0,082	0,076	0,068	0,072	0,21	0,28	0,36	**1**
20	Total coliform	MPN/100ml	1700	1600	1800	2100	2200	2300	2100	5200	5100	5300	**10.000**

3. Underground water quality

10 underground water samples were taken at the sub-project's work items.

The measuring parameters include pH, Hardness, TSS, COD, NH_4^+, Cl^-, NO_2^-, NO3-, SO42-, CN-, As^{3+}, Cd^{2+}, Pb^{2+}, Cu^{2+}, Zn^{2+}, Mn^{2+}, Cr^{+6}, Fe^{2+}, E.coli, Coliform.

Comparative standard:

- QCVN 09-MT:2015/BTNMT – National technical standard of underground water quality

Underground water sampling was conducted at the construction sites of the sub-project as shown in the following table:

Table 19: Sampling locations of the underground water environment

No	Code	Location	Coordinates	
			X	Y
Road connecting Nguyen Tat Thanh intersection with Au Co intersection – road no. 3				
1	NN1	Underground water in the residential quarter on Nguyen Tat Thanh road, Tan Thinh commune	2402622	0486925
Nam Cuong lakes 1,2,3 embankment				
2	NN2	Underground water at Mr. Pham Bao Ngoc's home - Dong Phu hamlet – Nam Cuong lake	2402776	0486925
3	NN3	Underground water at Mr. Nguyen Van Bang's home - Cau Den hamlet –Nam Cuong lake	2402499	0487212
4	NN4	Underground water at Ms. Ly Thi Nga's home - Dong Phu hamlet –Nam Cuong lake 3	2402745	0487126
Khe Dai, Hao Gia stream embankment				
5	NN5	Underground water in the residential quarter no.67 Yen Ninh ward – Khe Dai stream	2402651	0489367
6	NN6	Underground water in the residential quarter near Khe Lap bridge – Hao Gia stream	2402743	0490747
Road connecting Dien Bien rd. to the road connecting Bach Lam bridge to Van Phu bridge – road no. 1				
7	NN7	Underground water at Ms. Nguyen Thi Ha's home, group no. 24 on the road connecting NR37 – riverside road	2401851	0490315
Road connecting Bach Lam bridge to Van Phu bridge – road no. 2				
8	NN8	Underground water at Ms. Nguyen Thi Hoa's home, group no.39 near Tuan Quan bridge – Yen Linh ward	2400775	0489855
9	NN9	Underground water at Mr. Nguyen Van Nam - Tuy Loc hamlet, near Van Phu bridge	298744	0491607
10	NN10	Underground water in the residential quarter no.6 - Yen Ninh ward		

The analysis results of underground water quality at the construction sites of the sub-project's work items show that all the parameters are within the allowed limits according to QCVN 09 - MT: 2015/ BTNMT. In particular:

- Hardness is 2-3 times lower than the allowed limits;
- NH_4^+ is 10-100 times lower than the allowed limits;
- NO_3^- is 5- 7 times lower than the allowed limits;
- Coliform is 1.5 – 3 times lower than the allowed limits.

Hence, the underground water parameters are all much lower than the allowed limits and underground water in this area has not been polluted.

The analysis results of underground water quality at the construction sites of the sub-project's work items are shown in the following table:

Table 20: Analysis results of underground water samples

No	Parameter	Unit	NN1	NN2	NN3	NN4	NN5	NN6	NN7	NN8	NN9	NN10	QCVN 09-MT :2015
1	pH	-	6,45	7,12	7,08	6,86	6,92	6,96	6,58	6,63	6,68	6,65	**5,5-8,5**
2	Hardness	mg/l	290	225	228	216	221	218	225	228	231	218	**500**
3	TSS	mg/l	96,3	90,8	91,2	90,5	91,3	90,8	92,3	93,1	92,6	91,3	-
4	COD	mg/l	1,2	0,98	0,85	1,16	1,08	1,23	1,02	1,03	1,06	1,04	-
5	NH_4^+	mg/l	0,08	0,09	0,06	0,04	0,05	0,04	0,02	0,03	0,01	0,01	**1**
6	Cl^-	mg/l	24,8	19,7	20,6	26,3	26,4	26,8	28,1	27,2	26,3	25,4	**250**
7	NO_2^-	mg/l	0,06	0,08	0,09	0,09	0,08	0,07	0,04	0,06	0,08	0,07	**1**
8	NO_3^-	mg/l	3,09	1,96	1,92	2,16	2,25	2,28	2,38	2,56	2,64	2,53	**15**
9	SO_4^{2-}	mg/l	1	64,2	64,8	60,2	60,4	60,5	65,4	66,3	67,8	65,5	**400**
10	CN-	mg/l	0,54	0,58	0,62	0,38	0,42	0,46	0,52	0,64	0,48	0,51	-
11	As^{3+}	mg/l	0,016	0,018	0,026	0,023	0,026	0,028	0,038	0,045	0,021	0,025	**0,05**
12	Cd^{2+}	mg/l	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	**0,005**
13	Pb^{2+}	mg/l	0,009	0,005	0,003	0,004	0,003	0,005	0,006	0,009	0,008	0,009	**0,01**
14	Cu^{2+}	mg/l	0,18	0,087	0,092	0,09	0,086	0,085	0,12	0,18	0,36	0,28	**1**
15	Zn^{2+}	mg/l	0,63	0,21	0,26	0,36	0,38	0,29	0,45	0,39	0,46	0,4	**3**
16	Mn^{2+}	mg/l	0,02	0,04	0,05	0,04	0,06	0,08	0,09	0,08	0,06	0,06	**0,5**
17	Cr^{+6}	mg/l	0,006	0,008	0,009	0,003	0,004	0,006	0,007	0,006	0,008	0,005	**0,05**
18	Fe^{2+}	mg/l	1,52	1,26	1,32	1,06	1,08	1,21	1,18	1,21	1,26	1,22	**5**
19	E.coli	MPN/100 ml	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	KPH	**KPHT**
20	Coliform	MPN/100 ml	1	1	1	1	1	1	1	2	1	1	**3**

4. Wastewater characteristics

10 wastewater samples were taken at the sub-project's work items.

The measuring parameters include Temperature, Smell, pH, BOD_5, TSS, Sulfur, Ammonium, NO_3^-, Fe^{2+}, Zn^{2+}, Hg^{2+}, As^{2+}, Mn^{2+}, Cd^{2+}, Cu^{2+}, Tổng N, Tổng P, Coliform.

Comparative standard:

- QCVN 14:2008/BTNMT – National technical standard of wastewater quality, column B

The wastewater sampling locations in the sub-project area are shown in the table below:

Table 12: The wastewater sampling locations in the sub-project area

No	Code	Location	Coordinates	
			X	Y
Road no. 3 - Road connecting Nguyen Tat Thanh intersection with Au Co intersection , resettlement site no.3				
1	NT1	Wastewater in the residential quarter on Nguyen Tat Thanh road, Tan Thinh commune	2403145	0486724
Nam Cuong lakes 1,2,3 embankment				
2	NT2	Wastewater in the residential quarter near Mr. Pham Bao Ngoc's home - Dong Phu hamlet –Nam Cuong lake 1	2402376	0486608
3	NT3	Wastewater in the residential quarter near Mr. Nguyen Van Bang's home - Cau Den hamet –Nam Cuong ward	2402530	0487212
4	NT4	Wastewater in the residential quarter in Dong Phu hamlet near Ms. Ly Thi Nga's home –Nam Cuong lake 3	2402807	0486954
Khe Dai, Hào Gia stream embankment				
5	NT5	Wastewater in the residential quarter no. 67, Yen Ninh ward, Khe Dai stream	2402866	0489425
6	NT6	Wastewater in the residential quarter near Khe Lap stream, Hao Gia stream	2402866	0490919
Road no. 1 – Road connecting Dien Bien rd. to the road connecting Bach Lam bridge to Van Phu bridge, resettlement sites no. 1, 4,5				
7	NT7	Wastewater in the residential quarter no. 26 on the road connecting NR 37 – riverside road	2401851	0490459
Road no. 2 – Road connecting Bach Lam bridge to Van Phu bridge, resettlement site no. 2				
8	NT8	Wastewater in the residential quarter no.39 Tuan Quan bridge	2400818	0489639
9	NT9	Wastewater in the residential quarter in Tuy Loc hamlet near Van Phu bridge	2400560	0489855
10	NT10	Wastewater in the residential quarter no.6 near Bach Lam bridge		

Analysis results of the wastewater samples are shown in the table below:

Table 13: Analysis results of domestic wastewater samples in the sub-project area

No	Parameter	Unit	Road no 3, RS no3	NC lakes 1,2,3 embankment			Hao Gia, Khe Dai stream embankment		Road no1, RS no1,4,5	Road no. 2, RS no. 2			QCVN 14:2008 /BTNMT (column B)
			NT1	NT2	NT3	NT4	NT5	NT6	NT7	NT8	NT9	NT10	
1	Temperature	oC	27,8	28,1	28,3	26,8	27,1	27,3	27,3	28,3	28,5	28,3	-
2	Smell	-	Odour	Odour	Odour	Odour	Odour	Odour	Odour	Odour	Odour	Odour	-
3	pH	-	7,13	7,06	6,98	7,06	7,02	6,93	7,01	7,03	6,95	7,05	**5 - 9**
4	BOD_5	mg/l	**59,4**	**55,7**	**60,6**	**55,4**	**54,7**	**55,6**	**55,2**	**52,3**	**57,8**	**55,4**	**50**
5	TSS	mg/l	**121,4**	**128,5**	**134,7**	**129,4**	**128,5**	**131,7**	**126,5**	**127,3**	**134,6**	**123,5**	**100**
6	Sulfur	mg/l	0,12	0,26	0,18	0,28	0,36	0,47	0,32	0,38	0,41	0,34	**4**
7	Ammonium	mg/l	6,13	6,21	6,26	5,69	5,68	5,72	5,53	5,57	5,73	5,49	**10**
8	NO_3^-	mg/l	22,5	21,4	17,3	20,7	20,3	19,2	21,3	22,6	23,7	22,1	**50**
9	Fe	mg/l	0,76	0,84	0,89	0,73	0,64	0,67	0,82	0,73	0,62	0,58	-
10	Zn	mg/l	0,47	0,53	0,58	0,32	0,36	0,43	0,36	0,34	0,41	0,36	-
11	Hg	mg/l	0,001	0,002	0,002	0,002	0,001	0,003	0,001	0,002	0,001	0,002	-
12	As	mg/l	0,0028	0,0036	0,0024	0,0014	0,0018	0,0021	0,0024	0,0035	0,0037	0,0033	-
13	Mn	mg/l	0,16	0,21	0,26	0,13	0,25	0,21	0,17	0,23	0,27	0,26	-
14	Cd	mg/l	0,034	0,042	0,046	0,027	0,032	0,034	0,036	0,038	0,043	0,035	-
15	Cu	mg/l	0,066	0,068	0,072	0,035	0,038	0,042	0,046	0,049	0,043	0,041	-
16	Total N	mg/l	5,28	5,63	5,82	4,89	4,86	4,82	4,76	4,83	4,87	4,37	-
17	Total P	mg/l	2,6	2,18	2,53	2,4	2,08	2,57	2,3	2,27	2,43	2,36	-
18	Coliform	MPN/100 ml	**9300**	**9400**	**9600**	**8100**	**8200**	**8100**	**7800**	**7900**	**7700**	**8100**	**5000**

The wastewater quality analysis results in the above table show that:

- BOD_5 content in the wastewater samples is inconsiderably higher than the allowed limits (about 1.05-1.21 times)

- Suspended solid content in the wastewater samples ranges from 121.4 to 134.7 mg/l, about 1.21 – 1.35 times higher than QCVN 14: 2008/BTNMT.

- Sulfur, Ammonium, NO_3^- contents measured at the monitoring locations in the sub-project area are much lower than the allowed limits. Sulfur content is about 8.51 – 22.2 times lower than the allowed limits, Ammonium content 1.6 – 1.8 times lower than QCVN 14: 2008/BTNMT, column B;

- NO_3^- content is 2.1 – 2.9 times lower than the allowed limits.

- Coliform conten in the samples are 1.54 – 1.92 times higher than the allowed limits.

At the time of sampling, organoleptic examination of the wastewater quality shows signs of pollution in the sampling sites as most of the wastewater is discharged directly to the sewers and then to the streams without treatment. Analysis results in the above table show incipient contamination in suspended susbtances, BOD and coliform in all sampling locations. Therefore, the contractor must take appropriate measures to prevent further wastewater pollution around the construction sites when arranging domestic wastewater drainage for the camps.

5. Land environment

08 mud samples were taken at the sub-project's work items.

The measuring parameters include As, Cd, Cu, Pb, Zn.

Comparative standard: QCVN 03- MT:2015/BTNMT – National technical standard of limits of several heavy metals in soil (civil soil);

The mud analysis results are shown in the table below:

Table 14: Mud environment sampling locations

No	Code	Location	Coordinates	
			X	Y
Nam Cuong lakes no. 2,3 embankment				
1	D1	Mud in Nam Cuong lake 2	2402838	0486638
2	D2	Mud in Nam Cuong lake 3	2403053	0486839
Hao Gia, Khe Dai stream embankment				
3	D3	Mud in Khe Dai stream embankment	2402774	0489426
4	D4	Mud in Hao Gia stream embankment	2401974	0490373
Roads no. 1,2,3 and resettlement sites				
5	D5	Mud on the road connecting Dien Bien road – riverside road from Bach Lam bridge to Van Phu bridge	2401820	0490344
6	D6	Mud on the road connecting Tuan Quan bridge to Van Phu bridge	2401820	0490200

7	D7	Mud on Nguyen Tat Thanh road – Tan Thinh commune	2400404	0492614
8	D8	Mud near Bach Lam bridge		

Heavy metal analysis results are presented in the table below:

Table 15: Soil quality analysis results

No	Code	Unit	Nam Cuong lakes 2,3 emb.		Hao Gia, Khe Dai stream emb.		Roads and resettlement sites				QCVN 03-MT:2015 /BTNMT (Civil soil)
			D1	D2	D3	D4	D5	D6	D7	D8	
1	As	mg/kg	1,06	1,28	1,52	1,63	2,64	1,28	1,32	1,27	**15**
2	Cd	mg/kg	1,16	1,43	1,86	1,72	1,73	1,31	1,46	1,36	**2**
3	Cu	mg/kg	44,8	42,5	45,9	43,7	47,2	45,3	42,7	43,5	**100**
4	Pb	mg/kg	51,2	52,6	51,3	50,8	59,6	50,8	53,1	52,2	**70**
5	Zn	mg/kg	79	81	82,1	78,3	77,6	76,2	80,6	77,4	**200**

- As content in the soil samples ranges from 1.06 to 2.64 mg/kg, compared with QCVN 03-MT: 2015/BTNMT, all of 8 samples fall within the allowed limits.
- Cd content in the sampling locations is from 1.08 – 1.72 times lower than QCVN 03-MT:2015/BTNMT.
- Pb content ranges from 50.8 to 59.6 mg/kg, Pb content in all of 8 samples is lower than the allowed limts.
- Cu^{2+} content is about 2.1 – 2.4 times lower than QCVN 03-MT:2015/BTNMT;
- Zn^{2+} content is from 2.4 to 2.6 times lower than QCVN 03-MT:2015/BTNMT.

Mud and soil analysis results show that all the heavy metal parameters for civil soil are mush lower than the allowed limits, soil in the sub-project area has not been contaminated with heavy metals. Thus, the waste stone and soil may be used for elevating embankment and backfilling during the execution of work items.

6. Sediment mud quality

5 wastewater samples were taken at the sub-project's work items.

The measuring parameters include As, Cd, Cu, Pb, Zn.

Comparative standard: QCVN 43:2012/BTNMT – National technical of freshwater sediment;

Sampling locations in the sub-project area are as follows:

Table 16: Sediment mud sampling locations in the dredged lakes and streams

No	Code	Location	Coordinates	
			X	Y
	Nam Cuong lake 1 embankment			
1	TT1	Sediment taken in Nam Cuong lake 1 at the concrete road T-junction	2403668	0486351
2	TT2	Sediment taken in Nam Cuong lake 1 in Nam Cuong brick factory	2402438	0486264
3	TT3	Sediment taken in Nam Cuong lake 1 on Tran Binh Trong road	2402469	0486781
4	TT4	Sediment taken in Nam Cuong lake 1 at the concrete road T-junction towards Tran Binh Trong road	2401761	0487125
5	TT5	Sediment taken in Nam Cuong lake 1 – lake foundation	2402284	0487126
	Khe Dai, Hao Gia stream embankment			
6	TT6	Sediment in Khe Dai stream embankment site	2402774	0489426
7	TT7	Sediment in Hao Gia stream embankment site	2401974	0490373

Followings are analysis results of lake foundation sediment:

Table 17: Sediment quality analysis results

No	Parameters	Unit	Nam Cuong lake 1 embankment					Khe Dai, Hao Gia stream embankment		QCVN 43: 2012 /BTNMT
			TT1	TT2	TT3	TT4	TT5	TT6	TT7	
1	As	mg/kg	3,27	3,26	3,58	3,42	3,36	1,52	1,63	**17,0**
2	Cd	mg/kg	0,69	0,54	0,71	0,68	0,57	1,86	1,72	**3,5**
3	Cu	mg/kg	11,62	11,53	11,32	11,72	12,43	45,9	43,7	**197**
4	Pb	mg/kg	8,42	8,47	8,42	8,53	8,59	51,3	50,8	**91,3**
5	Zn	mg/kg	91	94	89	93	92	82,1	78,3	**315**

Comments: The analysis results show that heavy metal concentrations in the sediment are much lower than the allowed limits. Asen is 4.7 – 5.2 times lower than the allowed limts; Cd is about 4.9 – 6.5 times lower than the allowed limits; Cu is 15.8 – 17.4 lower than the allowed limits; Pb is about 10 times lower than the allowed limits.

Overall assessment: all the heavy metal parameters at the sampling locations are much lower than the allowed limits according to QCVN 43:2012/BTNMT on freshwater sediment. Thus, the sediment in the lakes and streams in the sub-project area is not polluted with heavy metals

and may be re-used to grow trees, elevate the gardens and low-lying fields.

2.1.6 Eco-system[8]

The diversified fauna, flora and genetic sources make enormous contribution to Yen Bai city's and Yen Bai Province's economic growth, particularly in agriculture, forestry and aquaculture, as they facilitate the production of plant and animal breeds, provide construction materials, raw materials and medicinal herbs. However, the socio-economic development has transformed the land uses and imported exotic breeds; climate change and population growth etc. have disturbed and altered the bio-resources.

At the present, there are 327 wood trees, 419 medicinal herbs, 225 food plants for animals and humans, such as fruit trees (67 species); starch and seed plants (24 species); Vegetable and spice plants (104 species), material and small industry – handicraft trees (152 species) such as snowbell, Chinese black olive, Chinese white olive, brindall berry, lauan meranti, etc.; common material plants (84 species) and ornamental and protective trees (170 species).

At the present, there are 227 species of animals in 80 families, 24 branches, including 49 species of mammals, 105 species of birds, 50 species of reptiles, 23 specicies of amphibians. Some precious species of animals such as purple pheasant, red-necked woodpeck, heron, giant kingfisher, etc., are falling in numbers.

The sub-project construction site is currently fallow land, the vegetation cover includes bushes, grass land, sparse forest, water surface; the vegetation cover in the agriculture eco-system area includes mostly bushes, small wood, sparse forest, mixed gardens; Animal includes mainly domestic animals, frog, toad, reptile, etc. There are no rare or endangered species of plants or animals in the sub-project area.

2.1.7. Land use status

With a total area of 10,678.00 hectares, the land use status is reflected in some main features such as agricultural land: 7,169.00 ha (66.95%), in which, productions forest land account for 36.56% (3,904ha), no specialised forest and protective forest, non-agricultural land accounts for 32.340% (3,452.90 ha) and unused land accounts for 0.71% (76.10 hectares) of the City's area. The land use status of Yen Bai Province is shown in the following table:

Table 18: Land use status in Yen Bai City [9]

TT	Land use purpose	Code	Area (ha)	Proportion, (%)
	Total		**10.678,00**	**100**
1	**Agricultural land**	***NNP***	***7.149,00***	***66,95***
1.1	Production agriculture land	SXN	3.020,50	28,29
1.2	Forestry land with forests	NLP	3.904,00	36,56

[8] Yen Bai Province Environment Status Report, 2011 – 2015 period

[9] 2016 Yen Bai Province Statistical Yearbook

TT	Land use purpose	Code	Area (ha)	Proportion, (%)
1.3	Aquaculture land	NTS	220,50	2,06
1.4	Other agricultural land	NKH	4,00	0,04
2	***Non-agricultural land***	***PNN***	***3.452,90***	***32,34***
2.1	Homstead land		681,00	6,38
2.1.1	Urban land	ODT/OTC	436,80	4,09
2.1.2	Rural land	ONT	244,20	2,29
2.2	Specialized land	CDG	1.888,50	17,69
2.3	Religion, belief land	TTN	8,80	0,08
2.4	Cemetery land	NTD	45,60	0,43
2.5	End river land and specialized water surface	SMN	823,60	7,71
2.6	Other non-agricultural land	PNK	5,40	0,05
3	***Unused land***	***CSD***	***76,10***	***0,71***

2.2. ECONOMIC CONDITIONS[10]

The economic structure shifted towards gradually increasing the share of industry and gradual reduction of the agricultural sector. According to statistics, in 2015, agriculture accounted for 5.4%, industry and construction 23.5% and service sector 71.1%.

Industry, small industry and handicrafts: Yen Bai is in the central location with transport infrastructure, industrial zones, abundant labor resources, etc., which is especially convenient for attracting investment projects of production and processing with the raw materials from the highly potential localities such as Yen Binh, Tran Yen. Therefore, the focus of resources on expansion of IZs, investment in technical infrastructure will promote Yen Bai city's development. In 2016, the value of industry-small industry and handicrafts (2010comparative price) in the city reached 2,761.3 billion dong, the city run portion is expected to reach 1661 billion = 100.7% of the plan. The production value of the construction industry in the city (2010comparative price) reached 1,230 billion; increased by 7% compared to 2015 = 100% of the plan.

Trade and services: Total retail sales is estimated at VND 6,850 billion = 95% of the plan. Export turnover is estimated at $ 23 million = 85% of the plan; the city run portion is estimated

[10] 2016 Stastical Yearbook and socio-economic reports by the communes and wards in 2016.

at $ 12 million = 120% of the plan. Budget revenue is estimated at VND420 billion = 100% of the plan.

Tourism: The development of landscape forests, recreation areas, the urban rehabilitation, etc. have made Yen Bai city more spacious and attracted more and more visitors to Yen Bai. Over the past years, millions of tourists have come to Yen Bai to visit the spiritual, cultural relics, beauty spots and attend tourism festivals. Turnover from hospitality and travel services in 2016 was 750 billion VND, export turnover is estimated at 750 billion VND = 107% of the plan.

Agro-forestry production: The value of agricultural, forestry and fishery production in 2016 reached VND 423 billion (2010comparative price), an increase of 6.3% compared to that of 2015, reaching 100% of the plan. The value of industrial production in the area (2010comparative price) reached 2820 billion dong = 94% of the plan. The city run portion was VND1,661 billion = 100.6% of the plan. The value of harvested products per hectare of arable and aquaculture land in 2016 reached 78 million VND = 93.97% of the plan.

Labor conditions: In 2016, 17,700 people in the Province attended vocational training, reaching and surpassing the plan, in which, 5,000 laborers were subsidized with vocational training under Project 1956. By the end of 2016, number of laborers received general training accounted for 47.5%, laborers received vocational training accounted for 32.4%. At present, there are 22 vocational schools in the Province: 02 vocational universities; 02 trường trung cấp nghề; 08 vocational centers and 10 establishements providing vocational training.

2.3. SOCIAL CONDITIONS

2.3.1. Population

Yen Bai's population has increased steadily over the years and maintained a stable population growth rate from 2012 to 2016. The population in 2016 was 101,059, an increase of more than 4,700 people as against 2012. The average population density was 946 persons / km2 with the lowest density recorded in Minh Bao, Tan Thinh, Van Phu and Phu Loc communes and the highest in central wards such as Hong Ha and Nguyen Thai Hoc. The urban population accounts for 77.51% and the rural population accounts for 22.49%, in which, women make up 49.98% in urban area and 49.94% in rural area. The rough birth rate in 2016 was 12.35‰, rough death rate was 5.02‰ and natural population growth rate was 7.33‰.

2.3.2. Impacts of natual disasters and weather

As a result of climate change's impacts, in recent years (from 2008 until now), rains have increased in quantity, intensity and duration, the existing capacity of the city's flood drainage works does not meet drainage demands, causing waterlogging and landslides across the city. The most severely waterlogged areas are Yen Ninh, Minh Tan, Dong Tam and Tan Thinh wards (basin 2) and Hong Ha, Nguyen Phuc, Nguyen Thai Hoc and Nam Cuong wards (basin 1). These are the cultural, political and economic centers of the city and Yen Bai Province with main drainage routes including streams such as Hao Gia, Cau Dai, Tuan Quan, Ngoi Yen, Ngoi Ong and Nam Cuong lake system.

According to the statistics of Yen Bai city, the provincial and city budget speds hundreds of billion dong every year to remedy the damage caused by floods, in addition to the toll of human

lives. Loss and damage are particularly serious in the downtown area (in basin 1 and basin 2) such as Yen Ninh, Minh Tan, Dong Tam, Nguyen Thai Hoc and Nam Cuong wards since this is the lowest part of the city.

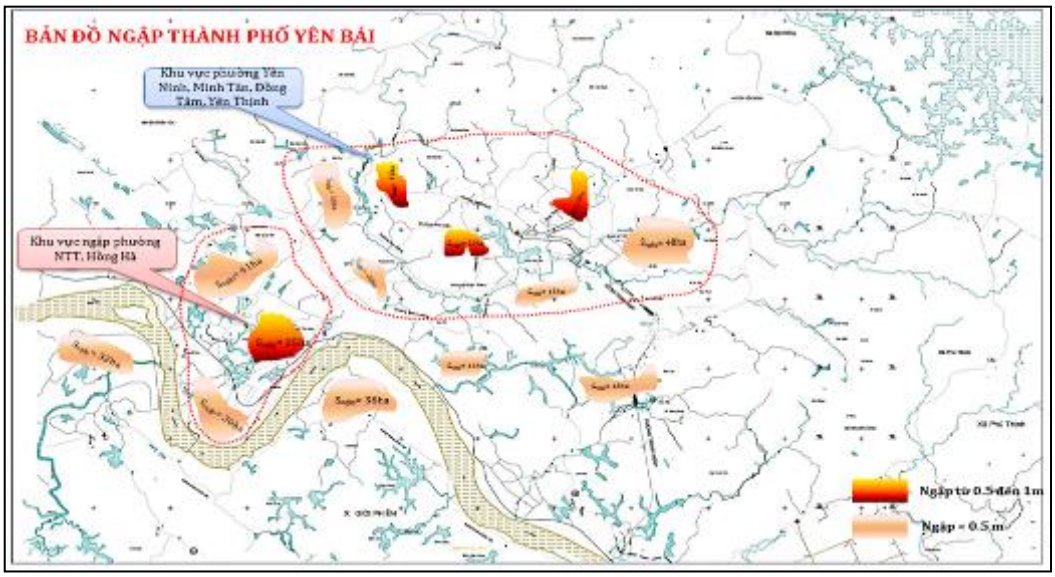


Figure 15: Flood map of Yen Bai City

Below are some recent flood images with increasing frequency and damaging impacts and some pictures of the streets which look like a river during the flooding time in the city:

Flood from 8 to 11 August 2008

Flood in July 2013

Flood on 30 January 2015

Flood on 19 August 2016

Flood on 18 July 2017

Flood in August 2017

Flood on 11 October 2017

Flood on 7 September 2017

Figure 16: Some pictures of flooding in Yen Bai City

Detailed figures on the damage caused by floods and rains in Yen Bai city over the years show the effects of nature on human in the recent time in the city of Yen Bai. Specifically:

Table 19: Losses caused by natural disasters in the sub-project area[11]

Date	Affected HHs	Location	Flooding depth (m)	Loss value	Others
08 Aug 2008-11 Aug 2008	8210	Tuy Loc, Nam Cuong, Hong Ha, Yen Ninh, Nguyen Thai Học, Nguyen Phuc communes	1 - 4	45 bil. dong	Rice inundated: 393.4ha, Secondary crop: 160ha 1.671 SM&HC units suffering from losses
25 May 2012	350	Hop Minh, Au Lau, Nam Cuong	0.3- 1.2	60 mi. dong worth of crop loss	60 roofs ripped off 45.5 ha of corn affected
30 Jul 2013	320	Many flooded streets	0.3 – 1	Tens of billion dong	139ha of crop
30 Jan 2015	1400	Hong Ha, Yen Ninh, Nguyen Thai Học, Nguyen Phuc	1-1.5	Tens of billion dong	2 dead, 1 injured, 14 houses collapsed,1,400 HHs displaced

[11] Report on damage caused by natural disasters in Yen Bai Province

Date	Affected HHs	Location	Flooding depth (m)	Loss value	Others
04 Sep 2015	100	Minh Tan ward	0.4-0.8		Traffic failure in a few hours in the wards of Yên Ninh, Minh Tân
24 May 2016	206	Cau Dai stream, Minh Tan, Yen Ninh, Nguyen Phuc, Nguyen Thai Hoc	0.5-0.9	200 mil. dong	
03 Aug 2016	145	Kim Dong Road, Nguyen Thai Hoc School	0.5-1.5		
19 Aug 2016	Hundreds	Hoang Hoa Tham, Thanh Nien, Tran Hung Dao, Nguyen Thai Hoc roads	1-3.5	Tens of billions dong	1,172 houses damaged, 282 houses flooded, 757 HHs displaced
1 Jan 2017 – 30 Aug 2017[12]	Hundreds	Au Lau, Van Tien, Phuc Loc, Gioi Phien, Van Phu, Minh Bao, Tuy Loc communes Nam Cuong, Yen Ninh, Nguyen Phuc, Hop Minh wards	1 – 3.0	Over 1 billion dong	Perennial crops, rice and fruit trees. Houses and other structures
October 2017[13]	22 people died, lost and injured	Yen Bai City	0.5-3.0	About 120 billion dong	Many properties and crops were destroyed, many public facilities were damaged

The above table provides specific statistics of the losses caused by natural disasters over the years in terms of human lives, properties, landslide, prolonged and serious flooding cause traffic congestion, crops and aquaproducts. Storm, combined with heavy rains and twister, especially in heavy and prolonged rains cause soil fall-in at slopes and increase water level in the inner-city streams, giving rise to inundation in many parts of the city and causing huge socio-economic losses. The project, upon its completion, is expected to strengthen the drainage capacity for the wards and communes of Van Tien, Tan Thanh, Minh Bao, Van Phu, Tuy Loc, Hong Ha, Dong Tam, Yen Thinh, Minh Tan, Yen Ninh, Nguyen Phuc, Nam Cuong, etc.

2.4. EXISTING INFRASTRUCTURE AND SERVICE SYSTEM

2.4.1. Transport

- Road:

Yen Bai City is the transport hub connecting the North West with the Northern Midlands.

+ Outbound communications: including 7 roads, e.g. Noi Bai – Lao Cai expressway, NH70, NH32, new NH32, NH37; There are two Red River bridges: Van Phu Bridge, Yen Bai Bridge; 02 bridges under construction: Tuan Quan Bridge, Bach Lam Bridge.

+ Local communications: Yen Bai has 84 inner-city roads with the length of 121,928 km, 51% of which (62.18km) meet urban standards. The remaining 59.748 km are not up to standards,

[12] Report on damage caused by natural disasters in Yen Bai city in 2017

[13] Report on flooding in Yen Bai City, October 2017

accounting for 49%. The urban road system in Yen Bai is arranged mainly following the natural terrain, connecting the old urban area and the center of km5. The pavement system is inadequate and imcomprehensive.

In recent years, Yen Bai City as well as Yen Bai Province are speeding up investment in transpor development: Yen Bai city 5 km bypass from Van Phu bridge to IC12 intersection on Noi Bai - Lao Cai expressway connects Yen Bai city center with Noi Bai - Lao Cai expressway. The flooding bypass from Van Phu bridge to Noi Bai - Lao Cai expressway has opened up new opportunities and paved the way for socio-economic development of Yen Bai Province, facilitating the regional connectivity on the Kunming - Lao Cai - Hanoi - Hai Phong economic corridor; it is the motivation for Yen Bai Province's competitiveness in the integration and development process.

Specialised roads include agricultural, forestry and national defense roads and primarily accommodate for seasonal transportation. 137 km of these roads meet the standards of grade A, B rural roads despite inadequate drainage systems.

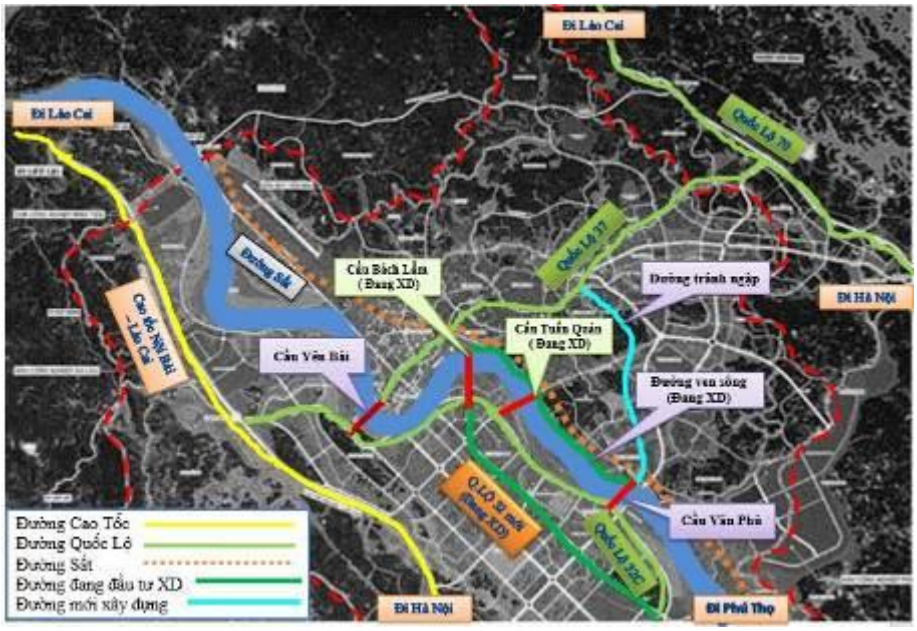


Figure 17: Key road system of Yen Bai City

Rural roads: Most of the roads are built up to the standards of grade VI, grade A, B - rural, many new routes have been opened but the travelling still depends on the weather. The low density of roads, mainly earth roads or 1m concrete roads built by the people themselves with low quality and small cross section. The construction of new roads from Dien Bien road to the riverside road, Bach Lam bridge to Van Phu bridge, from Nguyen Tat Thanh intersection to Au Co intersection will work to intensify the accessibility of the urban technical infrastructure services, accelerate goods and service circulation and exchange as well as local socio-economic development.

- Railway:

The Hai Phong - Hanoi - Yen Bai - Lao Cai - Yunnan (China) international railways crossing the city from have helped boost the economy as well as create regional links. However, the topographical, hydro-geological and railway signaling systems are outdated.

The traffic warning system and narrow gauge (1.1 meter) are backward and outdated. Train speed is low; stations, warehouses and services are of low quality.

- Waterways:

The waterway on the Red River crossing the city in a length of 115 km, 10 km of which from Van Phu – to Yen Bai is managed by the central government, flow of the remaining 105 km has not been cleared and ports and warehouses have not yet been constructed.

- Airport:

Yen Bai Airport is a grade II military airfield qualified for medium and light aircrafts such as the A320 and AN 26 to protect the North West of the country. 2.2 km long runway, parking lot suitable for medium-class military aircraft. Telecommunication command and control system are managed by the Ministry of National Defense. Currently, Yen Bai Airport is not part of the national transportation development strategy, so it is still a military airport in the future.

2.4.2. Water supply

At the present, Yen Bai Water Supply and Construction Joint Stock Company is responsible for supplying water to Yen Bai City and part of Yen Binh Town with the supply capacity of 16,500 m3 / day and water sourced from Thac Ba reservoir ans supplying for 100% of the population accessible to this clean water service. It satisfies 70-80% of the demand for water supply in Yen Bai and surrounding areas. The city's water supply system, though incapable to supply for the whole the city, substantially satisfies the current needs. Yen Bai Water Supply and Construction Joint Stock Company may flexibly adop forms of investment (the Company's owned equity, public-private partnerships, socialization, etc.) to broaden the scope of investment to suburban area and improve the water supply capacity of the system in the future.

2.4.3. Drainage and environmental sanitation

Environmental sanitation: In Yen Bai City, Nam Thanh Environment and Energy Joint Stock Company is responsible for waste collection. Nam Thanh Company is fully equipped with vehicles such as garbage collecting carts and specialized motorised vehicles. The inner city has public waste bins to ensure public hygiene. The collection of waste is carried out on the streets, in public places, residential areas, bus stations ... on 87 streets with an area of 600m^2 and 76 gathering points to ensure the maximum amount of solid waste collected, gathered, transported and treated. Nam Thanh Company has operated 340 waste collecting carts, 2 9-ton trucks, 1 dumper truck, 2 forklift trucks, 2 lift trucks for transportation of garbage. Domestic solid waste treatment technology is a recycling technology, 30% is re-cycled to make plastic resin, 50% for the production of micro-organic fertilizers, the remaining non-recyclable part (20%) are incinerated or buried.

The volume of solid waste collected is about 80 tons / day (accounts for 80% of the amount of solid waste generated, the majority of the remaining is concentrated in peri-urban areas). The rest is disposed at home gardens or places nearby. Because the composition of the waste is a decomposing organic substance, which accounts for over 65%, these components self-decay after a period of time in the natural environment. The current solid waste collection in Yen Bai city basically meets the current demand of the city.

2.4.4. Healthcare

The healthcare organisation structure and network continue to be strengthened and developed, infrastructure continues to be enhanced. The project for and the PPC's decision on the establishment of Obstetrics and Paediatrics Hospital and Disease Control Centre have been executed; Improve the organisation structure and human resources; Yen Bai Province General Hospital (500 beds); establish Yen Bai City Healthcare Centre; Van Chan District Healthcare Centre The epidemic prevention has been carried out efficiently, the epidemic monitoring system is reinforced from the grassroots level. Outbreaks of epidemics are detected early, allowing for timely control measures and curbing their expansion. Policy for attracting and developing the provincial human resources has been efficiently executed. Medical check-up and treatment receive great investment focus in terms of facilities and equipment, making the hospitals more spacious and modern; quality of the services are apparently heightened, many advanced technologies have been adopted. More importantly, the PPC entered into a comprehensive medical co-operation agreement with Bach Mai Hospital for 2017- 2021 period. 23/24 assignments laid down for 2016 were fulfilled, 6/6 socio-economic development assignments set for 2016 by the Province were also fulfilled. Vaccination rate for children under 1 year old reached 98.9%, 100% of the plan; 18 communes meet the national medical standards, 4 communes more than the plan.

2.4.5. Power supply and communication

Power supply for the whole city is the national power grid such as Thac Ba hydroelectric power plant with a capacity of 110MW and from Yen Bai 220 / 110kV station with a capacity of 2x125MVA and a power grid of 22KV. 100% of the construction sites use the above power source.

The infrastructure system of the post and telecommunications sector has been continuously upgraded to meet the communication needs of all organizations and individuals in need, and in the mean time to well serve the political and socio-economic development of the Province. 100% of the internal information network has been digitalized, 9 out of 9 districts, towns of the city have microwaves and automatic electronic switchboards.

2.5. SOCIO-ENVIRONMENTAL STATUS OF THE SUB-PROJECT AREA

The environmental and social status in the construction sites of the work items under the Yen Bai subproject is set out below:

(*) Nam Cuong lake 1 dredging and embankment

The lake system is built as an ecological park, including Nam Cuong lakes 1, 2, 3.

- In Lake no. 1, the lake bed has been deposited for many years and have not been dredged, an agricultural ecosystem has been formed on the deposited area because people practise cultivate on the encroached land.
- People reside in groups around the lake, main doors of some houses do not face the lake but mostly gardens, orchards and perennial land face the lake.

Figure 18: Existing condition of lake 1

(*) Nam Cuong lake 2 embankment

- The lake bed has been deposited, no solid road is available and there are many landslide sites.
- Population scatter around the lake, main doors of some houses face the lake.
- Lake 2 has not any drainage system, environment is clean without any sign of pollution.

Figure 19: Existing condition of lake 2

(*) Nam Cuong lake 3 embankment

- The lake bed has been deposited, no solid road is available and there are many landslide sites.
- Environment is clean without any sign of surface water pollution.
- Population scatters around the lake.

Figure 20: Existing condition of lake 3

(*) Construction of embankment for flood control on Hao Gia stream

- The lake system is located in the central area at Km5 and home to population and administrative organs of the Province.
- It helps drain surface water in the central area, collect water in the rainy season, control floods, regulate streams and beautify environmental landscape.

- Currently, the embankment of the lake has been seriously deteriorated, affecting the water retention and regulation capacity of the lake.
- People reside along the embankment, main doors do not face the embankment but face the existing road; domestic wastewater is discharged directly into the stream without treatment.

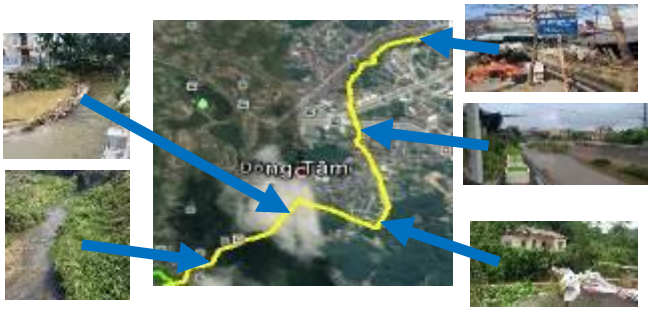


Figure 21: Existing condition of Hao Gia stream embankment site

(*) Construction of embankment on Cau Dai stream (Khe Dai stream)

- The beginning point is near the intersection of Yen Ninh road with Kim Dong road, the ending point of the route is Rose Kindergarten, about 2.86km long. The stream helps drain water for Yen Ninh ward, Minh Tan ward and Dong Tam ward.
- Houses are encroaching on both shores; garbage and sewage discharged by households directly to the stream; corridor road for operation and management is not available in some sections.

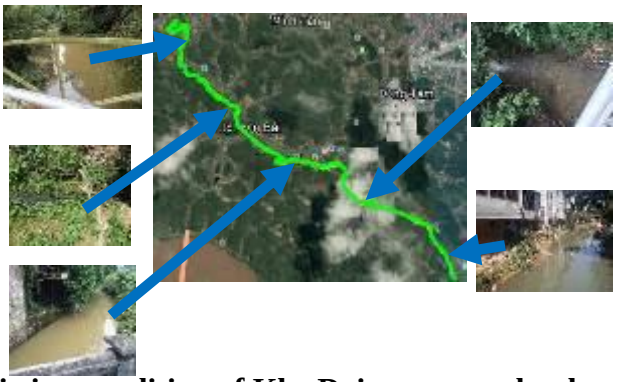


Figure 22: Existing condition of Khe Dai stream embankment site

(*) Construction of a road connecting from Dien Bien road to the riverside road (road from Bach Lam bridge to Van Phu bridge)

- The road connecting from Dien Bien road to the riverside road is a new route, the terrain of the route is mainly low hills scattered among residential areas.
- On both sides of the road, houses are scattered and intertwined with orchards and production forests.
- An earth road is available for local travelling.

Figure 23: Existing condition of the road from Dien Bien road to the road connecting Bach Lam bridge and Van Phu bridge

(*) Construction of a road connecting Bach Lam bridge to Van Phu bridge

- The terrain of the route consists of mostly low hills, mingled with small residential quarters and runs along the Red River.
- Hanoi – Lao Cai railroad runs through the beginning of the road (groups no. 6,7 – Yen Ninh ward).
- Currently, people are farming on the section crossing Van Phu commune.
- The population is sparse with mostly small camps and temporary houses along the construction site.

Figure 24: Existing condition of the road connecting Bach Lam bridge and Van Phu bridge

(*) Construction of a road connecting Nguyen Tat Thanh intersection with Au Co intersection

- The route connects from NH70 to Ha Noi - Lao Cai highway, section from Nguyen Tat Thanh road to Au Co intersection, the terrain of the route is mainly low hills, mingled with small residential areas.
- The construction route consists of mainly farming land, production forest, shrubs and grassland. There will no major losses of asset, house and structure incurred by local people.

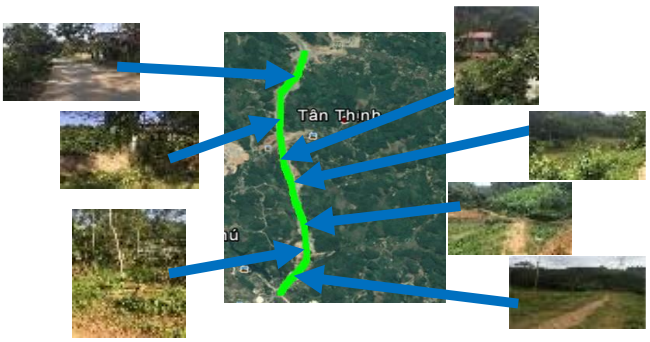


Figure 25: Existing condition of the road connecting Bach Lam bridge and Van Phu bridge

(*) Construciton of resettlement site no. 1

- Located near the end of the road from Dien Bien to the riverside.
- The existing area is production forest land of some households in Yen Ninh ward, consisting of mixed wood trees like acacia, banana, chinaberry, some shrub and grassland with low economic value or or even no value.
- There is no household in this area.
- Environment is clean.
- There is an earth road in front of the resettlement site.

Figure 26: Existing condition of Resettlement site no. 1

(*) Construciton of resettlement site no.2

- Located at the end of the road connecting Bach Lam bridge to Van Phu bridge, in Van Lien hamlet, Van Phu commune
- The area is currently empty, unused land in Van Phu commune.
- A number of homes scatter around. An irrigation channel near the residential area is available to help drain surface water and is not used for agricultural production.
- The surrounding area has no drainage system, people discharge directly to the garden, earth canal or the Red River.

Figure 27: Existing condition of Resettlement site no. 2

(*) Construciton of resettlement site no. 3

- Located at the beginning of the road connecting Nguyen Tat Thanh intersection with Au Co intersection on Nguyen Tat Thanh street
- Homes scatter.
- There is an earth road with gardens and production forest of people on two sides.
- Environment is clean without any sign of pollution.

Figure 28: Existing condition of Resettlement site no. 3

(*) Construciton of resettlement site no. 4

- Located in groups no. 6,7 in Yen Ninh ward, near Bach Lam bridge.
- Environment is clean without any sign of pollution.
- Homes scatter.
- The existing area is production forest land of some households.
- The surrounding area has no drainage system, people discharge directly to the garden, earth canal or the Red River.

Figure 29: Existing condition of Resettlement site no. 4

(*) Construciton of resettlement site no. 5

- ❖ Located in group no. 39 in Yen Ninh ward
- ❖ The existing area is empty land. Environment is clean without any sign of pollution.
- ❖ A number of homes scatter, vegetation cover includes bushes and grass and there is some empty land.
- ❖ There is no drainage system, wastewater is discharged directly into their gardens but due to large area and small population, wastewater is treated by the natural environment, thus, no sign of water pollution has been found.

Figure 30: Existing condition of Resettlement site no. 5

2.6. SENSITIVE AREAS OF THE SUB-PROJECT

Sensitive areas of the sub-project are shown in the table below:

Table 20: Sensitive points in the sub-project area

No.	Sensitive points	Description	Distance (m)
	Construction of embankment for Nam Cuong lakes 1, 2, 3 (7 sensitive areas)		
1.	All-purpose communal house 	- Located at Cau Den residential quarter, intersection between Le Chan road and riverside road no.2 - Number of attendants: 130 people in the ward - Frequency: 1 time/week in the evening. - Located on the embankment route and lake 2 walkway. - Clean environment without any reported pollution.	36
2.	Healthcare station 	- Located on the road near the residential area adjacent to the lake. - Number of visitors: 20 persons/months - Working hours: administrative hours but staff is on duty 24/24. - Clean environment.	51
3.	Cau Den hamlet communal house 	- Located at the conjunction between Le Chan road and lake walkway - This is the communal house of people in Cau Den hamlet. - Opened mainly in the evening. - Population reside along the embankment route, environment is clean.	0
4.	Nam Cường primary school 	- Located on the road along Nam Cuong lake - Number of pupils: more than 400, 25 teachers	295

No.	Sensitive points	Description	Distance (m)
		- Opening hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30. - Population reside scatter along the route, environment is clean.	
5.	Sơn Ca Nursesy school 	- Located in Cau Den hamlet, Nam Cuong ward - Located on the existing concrete road of lake 2 - Number of pupils: more than 300, 25 teachers - Opening hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30. - Clean environment.	230
6.	Martyrs Cemetery 	- In Nam Tho residential quarter, Nam Cuong ward - There are 48 graves of the martyrs - Located on the existing concrete road of lake 2 - Visitors, who are mostly local people, only come in the the government's ceremonies and in the beginning or end of year to clean up the graves. - Scattered population. Clean environment.	20
7.	Mother temple, Van Thang pagoda 	- Located on the existing concrete road of lake 2 and lake 3 - This is where cultural activities take place, especially in festival season, typically January of lunar calendar. - Clean environment.	0
	Construction of embankment for Khe Dai stream (4 sensitive arears)		
8.	Yen Ninh ward healthcare station 	- In group no. 56, Yen Ninh ward - Khe Dai stream embankment in the back. - Number of visitors: approximately 30 persons/month - Working hours: administrative hours but staff is on duty 24/7. - People reside along the route.	380
9.	Minh Tan ward market 	- In group no. 26, Minh Tan ward - Number of frequent visitors: 500 people - Main activities: trading, business - Opening hours: from 5.00 to 18.00 every day. - This is a hustling market of the ward.	80

No.	Sensitive points	Description	Distance (m)
		- People reside along the route. Environment is clean.	
10	Kim Dong Primary School 	- In group no.31, Minh Tan ward - Working days: from Monday to Friday - There are about 1,000 pupils and 50 teachers - Opening hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30. - People reside along the route. Environment is clean.	5
11	Rose Kindergarten 	- In group no. 50, Minh Tan ward - There are about 300 pupils and 25 teachers - Opening hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30. - People reside along the alley to Rose Kindergarten. Environment is clean.	5
	Road connecting from Nguyen Tat Thanh road to Au Co intersection (5 sensitive arears)		
12	Nguyen Tat Thanh High School 	- In Luong Thinh 2 hamlet, Tan Thinh commune - There are about 800 students and 34 teachers - Opening hours: 6h30 – 7h30, 11h-12h, 13h-14h and16h30-17h30.	975
13	Nguyen Hue High School 	- In Luong Thinh 2 hamlet, Tan Thinh commune - There are about 300 students and 25 teachers - Opening hours: 6h30 – 7h30, 11h-12h, 13h-14h and 6h30-17h30.	920
14	Tan Thinh church 	- In Thanh Hung 1 hamlet, Tan Thinh commune - Number of frequent visitors: 200/630 catholics. - Service time: 19h at weekdays and 8.00 and 19h30 at weekends.	50
15	Nguyen Trai Primary School 	- In Luong Thinh 2 hamlet, Tan Thinh commune - There are about 300 students 25 teachers - Opening hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	970

No.	Sensitive points	Description	Distance (m)
16	Tan Thinh commune healthcare station 	- In Thanh Hung 3 hamlet, Tan Thinh commune - Located on the road to be constructed, sparse population, 2.5 – 3m earth road. - Number of visitors: about 30 people/month - Working hours: administrative hours but staff is on duty 24/7.	380
	Road connecting from Bach Lam bridge to Van Phu bridge (5 sensitive arears)		
17	Vocational college 	- Located on an inter-commune road, scattered population. - About 500 sudents - Working hours: administrative hours 24/5, off at weekend.	420
18	Van Phu hamlet communal house 	- Located in Van Phu hamlet - Number of attendants: 60 people - Frequency: 1 time/week in the evening - Population scatter, vegetation cover includes mainly bushes, grass and small wood trees.	1080
19	Van Phu Secondary and Primary School 	- Number of students: about 1080. - Population scatter, vegetation cover includes mainly bushes, grass and small wood trees, without drainage system along the route. - Working hours: 6h30 - 7h30, 11h-12h, 13h-14h and 16h30-17h30.	0
20	Tuy Loc hamlet communal house 	- Located in Tuy Loc hamlet, next to the road to be constructed, population scatters, vegetation cover includes mainly bushes and grass. - Number of attendants: 50 people - Frequency: 1 time/week in the evening.	70
21	Van Phu pagoda and temple 	- Type of land: TON - Located in Tuy Loc hamlet, population scatter, vegetation cover includes mainly bushes and grass. - Number of attendants: 50 people in the ward - Religious activities take place in the annual Buddism festivals (quiet-seeking ritual, Buddha's birthday ceremony, ghost festival, etc.)	2000

CHAPTER 3. ALTERNATIVE ANALYSIS

During the impact assessment of the sub-project, analysis of alternatives is a significant step in the assessment process. The main purpose of analysing alternatives is to identify the location, design and technology applicable to each specific component of the sub-project so as to minimize the negative impacts and maximinze the positive ones. The analysis of alternatives has been conducted for each component of the sub-project in technical, economic, social and environment aspects. The analysis outcomes are presented hereunder.

3.1. WITH-PROJECT AND WITHOUT SUBPROJECT

As assessed in respect of status of Yen Bai city in Chapter 2 hereinabove, without sub-project, the City's negative and disadvantageous considerations in respect of environmental and social aspects remain existed:

- **Flooding and social safety**: flooding, landslide and waterlogging occur frequently with increasing rate in the whole Yen Bai city, especially in Yen Ninh, Minh Tan, Dong Tam, Tan Thinh wards (basin 2) and Hong Ha, Nguyen Phuc, Nguyen Thai Hoc ward (basin 1).
- **Environmental pollution**: along Hao Gia and Khe Dai streams, the wastewater from households, restaurants, hotels, commercial centers, etc. is not treated or unthoroughly treated. Besides, there is no culvert system for collecting the wastewater along the embankment. Therefore, the wastewater is directly discharged into the streams, causing impact on the environment and urban aesthetics.
- **Increase of wastewater and sewage:** the growth of urban size and increasing population increase the demands, including domestic water and other eating, drinking demands, which increases the volume of wastewater and sewage, putting heavy pressure on the surrounding environment.
- **Urban safety**: The inconvenient traffic, degraded, small and under-standard urban roads as well as the weak circulation capacity have become a tremendous hindrance for the economic development and improvement of living quality.

The development of environmental and social matters in "WITH" and "WITHOUT" sub-project cases is compared in the table below.

Table 21: Environment quality in "WITH" and "WITHOUT" sub-project cases

No	Environmental and social matters	"Without" Sub-project case	"With" Sub-project case
	Embankments of Nam Cuong lake 1,2,3, Hao Gia stream and Khe Dai stream		
1.	Air quality	- Not affected by the construction activities	- Dust and noise levels will be increased during the construction; however, this impact is temporary, partial and controllable. - During the operation phase, the emission from traffic vehicles will be increased when the traffic volume increases.
		- Odour pollution from stagnated sewage and wastewater in vairous sections of Hao Gia and Khe Dai	- Odour pollution from stagnated sewage and wastewater is treated because they are collected and discharged into the drainage

No	Environmental and social matters	"Without" Sub-project case	"With" Sub-project case
		streams.	culvert system.
2.	Surface water quality	- Not affected by the construction activities and no increased impact during the operation process	- Construction of embankment works, bridge over the streams or construction activities near the surface flows in Nam Cuong lake, Hao Gia and Khe Dai stream embankment may increase the content of TSS, BOD_5, coliform, etc. which only appear during the construction time and they can be controlled.
		- Odour pollution from stagnated sewage and wastewater in vairous sections of Hao Gia and Khe Dai streams because the local people freely and directly discharge untreated sewage into the streams.	- Polluted surface water in the streams from stagnated sewage and wastewater is treated after being collected a drainage culvert system will be made available.
3.	Underground water quality	- Not affected	- Not affected if proper control over the discharge of harmful waste from the construction and daily activities of the workers in the site camps is applied.
4.	Soil	- Not affected	- The sub-project barely changes the soil quality in the project area. - Risk of landslide and collapse will be mitigated when the slopes are rehabilitated, strengthened or embanked.
5.	Land acquisition and resettlement	- Not affected by the land acquisition and resettlement.	- As scheduled, about 268 households will be affected, in which 219 households will be affected with their residential land and 60 households will be displaced to the resettlement area.
6.	Increase of land price	- The land price is low.	- The impacts mainly relate to the change of land use purpose, i.e. from agricultural land to other ones, decrease of income and earnings from such land area brought to the affected households. - Promote trade, commerical intercourse, service business in each land plot. - Increase the chances and conditions for development of land site in the inner and contiguous areas.
7.	Drainage capacity	- The whole City is frequently flooded, the drainage capacity is poor, causing impact on the people's daily activities, travel, business and trade in the area	- Local flooding will arise during the construction process at the construction sites of Hao Gia, Khe Dai stream and Nam Cuong lake embankments. - Resolve the flooding due to sediment, increase the water reserve area and drainage capacity in Nam Cuong balancing lake and in the beds of Hao Gia and Khe Dai streams. - Decrease the flow velocity and mitigate the landslide and collapse along the two banks of Hao Gia, Khe Dai streams and Nam Cuong lake. - Enhance the wastewater drainage capacity in the sides of embankments and richen the

No	Environmental and social matters	"Without" Sub-project case	"With" Sub-project case
			urban landscape.
8.	Environmental sanitation and community health conditions	- Degradation of environmental sanitation, increases of diseases due to flooding and polluted water sources.	- Improve the environmental sanitation and community health conditions by enhancing the drainage capacity, control of flooding and developing a healthy ecological system in the areas of Hao Gia and Khe Dai stream embankment as well as in Nam Cuong balancing lake. - Environmental sanitation and community health will be improved, especially for those who live along the embankments of Hao Gia and Khe Dai streams.
9.	Urban landscape	- Urban landscape is not improved and tends to be unattractive.	- Develop urban landscape: the embankent routes and walk roads along the stream banks, lake bank; improvement of the public space, rehabilitation of the traditional architectures, tree-planting, etc.
10.	Isolation of residential area and production land; Interruption of people's daily activities.	- The residential area and production land will remain unchanged as it has been and not be divided. - People's lives and their daily activities as well as the public relations will not be affected.	- Some sections will be deepened or filled higher than the existing ground level, resulting in isolation of the residential areas. This impact will be mitigated by the design measures, such as arrangement of the underpasses or ramps connecting the divided areas with the detours, having regarded to the safety. - Lives and daily activities of people in the City will be affected.
11.	Benefits	- Decrease the living quality and conditions of people, especially in the frequently flooded and slipped areas. - Increase the worry of people living along the two sides of stream embankments about the safety and environmental hygiene. - Regional connectivity, promotion of developing the contiguous urban areas, etc are at low development.	- The project provides direct benefits from mitigation of flooding, enhancement of regional environmental quality, improvement of living condition, etc for households living along the two embankments of Hao Gia and Khe Dai streams, the people living around Nam Cuong lake and in Nam Cuong ward and the people living along the routes and in Yen Ninh, Minh Tan wards, Van Phu and Tan Thinh communes. - Improve the quality and conditions of living environment as well as the urban landscape. - Increase the reserve volume and adjust the water reserve capacity and flooding drainage capacity, moderate the water level in the beds of Hao Gia, Khe Dai streams and Nam Cuong ecological reservoir. - Improve traffic conditions, decrease pressure of transportation and circulation in the urban roads, promote the local socio-economic development at the construction areas of roads, embankments and bridges. - Increase the dynamism, create the benchmarks for growth and development of Yen Bai city, connect and link with the

No	Environmental and social matters	"Without" Sub-project case	"With" Sub-project case
			Northern areas for mutual development.
	Roads no. 1,2 ,3		
1.	Air quality	- Not affected by the construction activities	- Dust and noise levels will be increased during the construction, however, this impact is temporary, partial and controllable. - During the operation phase, the emission from traffic vehicles will be increased when the traffic volume increases.
2.	Underground water quality	- Not affected	- Not affected if good control measures of discharging harmful waste from the construction, daily activities of the workers in the site huts are applied.
3.	Land acquisition and resettlement	- Not affected by the land acquisition and resettlement	- As scheduled, about 603 households will be affected, in which 76 households are relocated to the resettlement area.
4.	Increase of land price	- The land price is low	- The impacts mainly relate to the change of land use purpose, i.e. from agricultural land to other ones, decrease of income sources and earnings from such land area brought to the affected households. - Increase the chance of trade, commerical intercourse, service business-running, etc in each land slot. - Increase the chances and conditions for development of land site in the inner and contiguous areas.
5.	Urban landscape	- Urban landscape is not improved and tends to be unattractive.	- Develop urban landscape: constructed roads will create open spaces along two sides; public spaces will be improved, traditional architectures will be rehabilitated, trees will be planted, etc.
6.	Isolation of the residential area and production land; Interruption of the people's daily activities	- The residential area and production land will remain unchanged as it has been and not be divided. - People's lives and their daily activities as well as the public relations will not be affected.	- Some sections will be deepened or filled higher than the existing grould level, resulting in isolation of the production land, or between the production land and residential areas. This impact will be mitigated by the design measures, such as underpasses or ramps connecting the divided areas with the detours, having regarded to the safety. - Lives and daily activities of people in the City as well as public relations will be affected because of the construction and resettlement for the affected households.
7.	Benefits	- Decrease the living quality and conditions of people, especially in the frequently flooded areas. - Increase traffic pressure on the roads in the coming time. - Regional connectivity, promotion of developing the	- Improve the quality and conditions of living environment as well as the urban landscape. - Improve traffic conditions, decrease pressure of transportation and circulation on the urban roads, promote the local socio-economic development at the construction

No	Environmental and social matters	"Without" Sub-project case	"With" Sub-project case
		contiguous urban areas, etc is at low level	areas of roads, embankments and bridges. - Increase the dynamism, create the benchmarks for growth and development of Yen Bai city, connect and link with the Northern areas for mutual development.
	Resettlement sites		
1.	Air quality	- Not affected by the construction activities.	- Dust and noise levels will be increased during the construction, however, this impact is temporary, partially and controllable.
2.	Surface water quality	- Not affected by the construction activities and there remains no impact increased during the operation process	- Construction of roads near the surface flows adjacent to the Red river may increase the content of TSS, BOD5, coliform, etc. However, the impacts only appear during the construction time and they can be controlled.
3.	Land acquisition and resettlement	- Not affected by the land acquisition and resettlement.	- As scheduled, about121households will be affected, in which no household is subject to the resettlement.
4.	Increase of land price	- The land price is low	- The impacts mainly relate to the change of land use purpose, i.e. from agricultural land to other ones, decrease of income sources and earnings from such land area brought to the affected households. - Increase the chance of trade, commerical intercourse, service business-running, etc in each land slot. - Increase the chances and conditions for development of land site in the inner and contiguous areas.
5.	Benefits	- Decrease the living quality and conditions of people, especially in the frequently flooded and landslided areas; - Increase the worry of people living along the two sides of stream embankments about the safety and environmental hygiene. -	- Provide confortable and convenient accommodation to the households living under the permitted level of safety and convenience in their existing accommodation. - Satisfy the demands of the household relocated to the resettlement area. - Stabilize the life and works in the new residential area with those who have the same culture, customs and habit.

The comparison table hereinabove shows that construction of various items under the sub-project may cause impacts on the surrounding residential communities and workers from dust, exhaust, noise, vibration, wastewater, sewage, hygiene conditions, etc. But, these impacts are not significant; just exist only for a short time of construction and they can be mitigated by proper measures.

The items under the sub-project after being put into operation will generate significant benefits to Yen Bai city in particular and the mountainous midland regions of the North in general. The sub-project will (i) create the motive force for sustainable economic development, provide jobs and stable earnings for a large number of people from the new careers after the transport roads are developed. (ii) create favorable conditions to trade with the whole mountainous midland of

the North at the aim of promoting economic development in the fields of industry, handicraft, commerce, service and tourism. (iii) attract and lure the potential investors who have good financial capability to feel assured and carry their business activities because of an improved environment, especially the overcoming of flooding, negative impacts from climate change thus making contribution to GDP growth. (iv) increase the land price in the region after the sub-project is invested and put into use. In general, the effects from "with sub-project" will provide significant motive force for development and sustainable development of Yen Bai city in the future.

3.2. THE SOCIAL ENVIRONMENT FACTORS CONSIDERED DURING PREPARATION OF FEASIBILITY STUDY

The following matters have been considered and examined in identifying location during preparation of FS for the work items invested and constructed in the city, namely:

- **Socio-economic development** will result in environmental pollution problems. To ensure the development and come to the sustainable development, these environmental pollution problems must be resolved. One of the measures is to consolidate the stream embankment infrastructure, develop wastewater collection culvert system, rainwater drainage ditches and canals, dredge the beds of streamsand reservoirs, strengthen the urban transport system to enhance connectivity and make commercial intercourse in the city and the region.
- **The constructed locations may be affected by land acquisition** due to site clearance in service of constructing the work items. However, during the survey, the positioning of affected area, studying construction methods of the works and discussions with the Management Unit, local authority and community representatives of locality where the project is proposed, have been conducted. Therefore, the acquired land area is properly calculated and cut off in the unnecessary location; the alignment and area are adjusted so as to minimize going through the existing area where the houses, architectural works, trees, etc of the local residents exist.
- **Flooding mitigation and inundation drainage:** Proposal of measures for construction of embankment, walkpaths around the lake, dredging the embankment and lake to increase the water reserve capacity and decrease the flow velocity in the design areas for the purpose of enhancing inundation drainage capacity, decline the height and flooding frequency, etc have been worked out to mitigate the damage against the local people;
- **Improvement of living quality:** the selection of constructing embankments of streams and Nam Cuong lake is considered one of the dynamism investment step, at the aim of improving aesthetics, value and living quality of the local residents, creating benchmarks for the locality as well as encouraging and attracting the investment into the location in the time to come.
- **Consilidation of inner transport system:** Comply with the design standard and road transportation capacity, enhance the connectivity in the city and the main roads for regional transportation, the roads linking two banks of the Red river in the City and in the region, contributing to completion of connectivity, development of the city towards a comprehensive and modern model which is open to the to create momentum for promotion of socio-economic development and investment attraction.

3.3. ANALYSIS OF PROPOSED ALTERNATIVES

(1) Scale and efficiency of embankment:

To determine the size and efficiency of the aforesaid works, the Consultant has applied hydrauric models MIKE 11 and MIKE 21, hydrologic model MIKE NAM in calculation. According to these models, the researched river network is divided into single river sections by the cross sections. The river sections are contiguous to each other according to their natural status. By the above method, difference formula and linearization, it will provide a difference equation for the whole river network via mesh difference. Solving the difference equation will generate the required root at the mesh, in particular, we can find the water level at the sectional positions and sectional positions +2*dx, flow at sectional posisions +dx and the positions of the works, such as culvert, dam, etc, in the whole river network after each calculated time step.

As above-analysed, the calculation of hydrologic aspect, flooding in the Red river and the rain causing flood in Yen Bai city is not uniform (not happened simultaneously to each other) while the goal of embankment of Cau Dai and Hao Gia streams is for flooding drainage. Obviously, it can be confirmed that the embankment these streams is only meaningful for drainage due to the local rain.

From the above analysis, we propose to calculate the design frequency for embankments of Cau Dai and Hao Gia P=2% caused by rain. Calculation result of design frequency P=2%, flooded area due to upstream flood combined with high water level in the downstream after rehabilitation of Hao Gia, Cau Dai streams and Nam Cuong lake shows that it can reduce 50-60% of flooded area compared to the time before rehabilitation. The design flooding water level for embankments of Cau Dai and Hao Gia at the flow merging section is +32.1m. The design water level for Cau Dai embankment at Tuan Quan flow merging section is +29.1m.

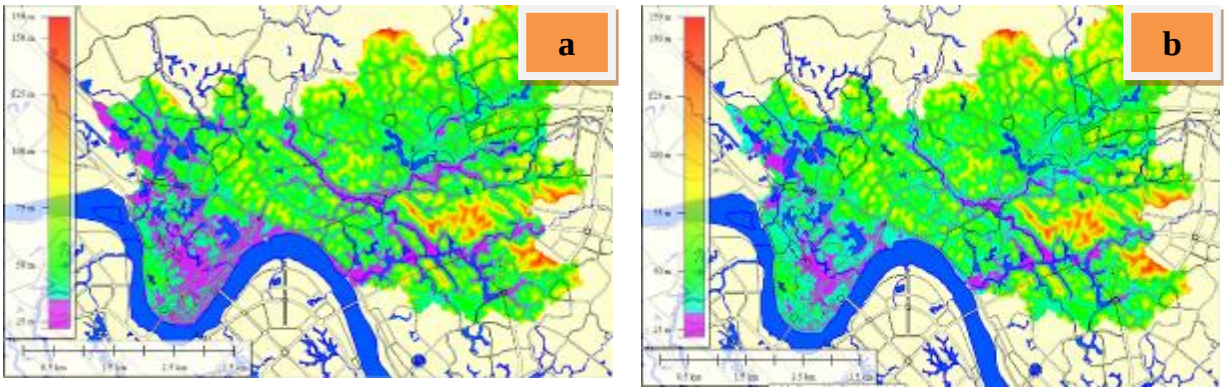


Figure 31: Flooding map before (a) and after (b) rehabilitation – P=2%

Calculation of rain with different frequencies shows that:

Table 31: Comparison of flooded area before and after rehabiliation of Nam Cuong lake embankment

Frequency	Flooded area (ha)		Maximum flooding depth(m)	
	Before rehabilitation	After rehabilitation	Before rehabilitation	After rehabilitation
1%	340.6	166.9	1.52	1.17
2%	309.6	114.6	0.92	0.47
5%	278.6	72.4	0.76	0.56

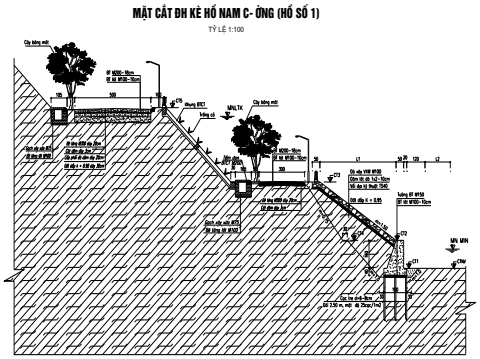
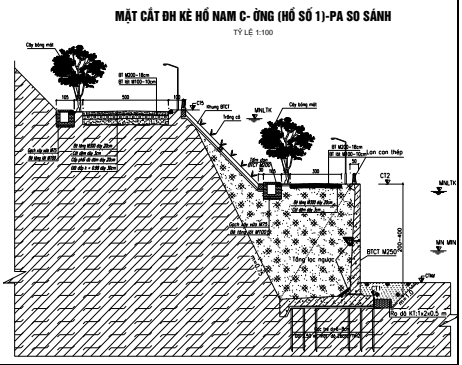
Frequency	Flooded area (ha)		Maximum flooding depth(m)	
	Before rehabilitation	After rehabilitation	Before rehabilitation	After rehabilitation
20%	195.0	41.0	0.56	0.34
100%	97.5	13.7	0.14	0.04

The said parameters ensure both connection of existing embankment system in the locality and make high efficiency of flooding reduction. For flooding frequency 2%, the efficiency of the proposed works with flood reduction reaches 60-65%, the flooded depth reduces by 0.5-1m. It is obvious that the calculated size of proposed works is appropriate.

Comparison of design options for embankments of Nam Cuong lakes 1, 2, 3:

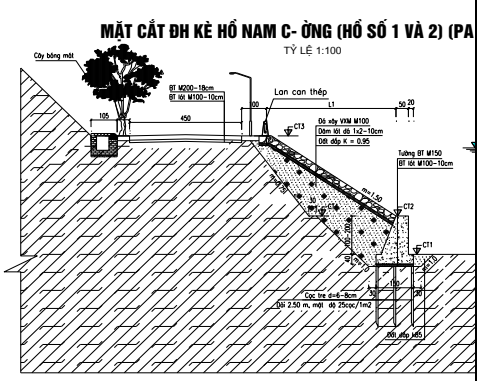
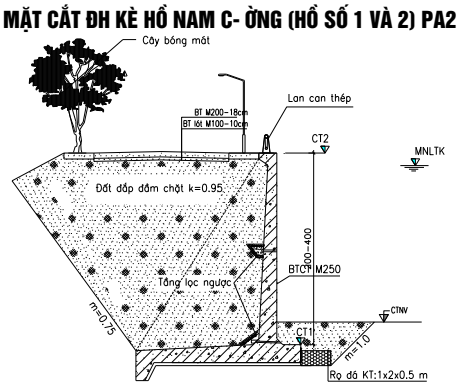
Table 32: Design options for Nam Cuong lake 1

Items	Option 1 – Lake 1	Option 2 – Lake 1
Specification	- The embankment with upright wall, slope, slope's middle part is 0.5m higher than frequent backwater level. - The embankment root is constructed by gravity concrete M150, expected height of 2m. - Embankment body: from the top of root supporting wall to the slope's middle part, place cement concrete M200, 15cm thick, with full drainage system. The embankment slope from the slope's middle part to the top of embankment is planted with grass in the concrete frames. - Slope's middle part: combined as walk road, pavement of concrete structure M250, 18cm thick, cross slope i=2%. - Embankment peak: Combined as transport road and operation management road. (i) Roadway width: 5.5m; (ii) Pavement structure: Top-down pavement structure as follows: Concrete M300, 20cm thick, cross slope 2%, under the concrete layer, there is an aggregate layer type 1, 20cm thick, filling soil k=0.98, 30cm thick. (iii) In addition: the road edge is planted with trees for landscape and designed with accompanying drainage system and lighting system. (iv) Install rain drainage system along the embankment of the lake, plant trees and arrange lighting system as appropriate.	- The embankment with upright wall, slope, slope's middle part is 0.5m higher than frequent backwater level. The part from the embankment top to the slope's middle part is similar to Option 1; the part from the slope's middle part downwards is totally made of re-inforced concrete slope wall.

Items	Option 1 – Lake 1	Option 2 – Lake 1
		
Technical advantages	- This is common option, taking full use of local material and common workers. - Simple technique and quick construction - Suitable to various terrain with low difference of height, small flow velocity and stable water level. - Low cost. - Flooded height: reducing the water level in the lake downstream to 0.36m in Ngoi Ong stream.	- Save the area - High aesthetics - Flooded height: reducing the water level in the lake downstream to 0.36min Ngoi Ong stream.
Technical disadvantages	- Less aesthetic	- Complicated method of construction that requires high-qualified manpower, modern plant and equipment, so it cannot take full use of local common workers. - High construction cost.
Economic aspect	- Lower construction cost - Dredged volume: 140,000 m3	- Higher construction cost' - Dredged volume: 315,000 m3.
Environment	- Increase the fresh water reserve capacity for Nam Cuong ward; - Increase the air-conditioning capacity, micro-climate and develop ecological environment; - Enhance drainage capacity for various areas of Nam Cuong, Hong Ha, Nguyen Thai Hoc wards while reducing the flooding.	- Increase the fresh water reserve capacity for Nam Cuong ward; - Increase the air-conditioning capacity, micro-climate and develop ecological environment; - Enhance drainage capacity for various areas of Nam Cuong, Hong Ha, Nguyen Thai Hoc wards while reducing the flooding..
Social aspect	- 6 households are affected, no household is relocated to the resettlement area; the affected area is approximate 0.8ha. - Improve the local people's living conditions. - Form an ecological area of the city. - Balance air and water for the Northwest of the City. - 100% of people and authority agree with and support the project.	- 6 households are affected, no household is relocated to the resettlement area; the affected area is approximate 0.8ha. - Improve the local people's living conditions. - Form an ecological area of the city. - Balance air and water for the Northwest of the City. - 100% of people and authority agree with and support the project..
Selection	From the premarily comparison in the above table and the actual characteristics of the flow in the lake bed with small velocity, quite stable water level and insignficant	

Items	Option 1 – Lake 1	Option 2 – Lake 1
	difference between lake bank and bottom height, **Option 1** is proposed to be selected as the design option.	

Table 33: Design options for Nam Cuong lakes 2,3

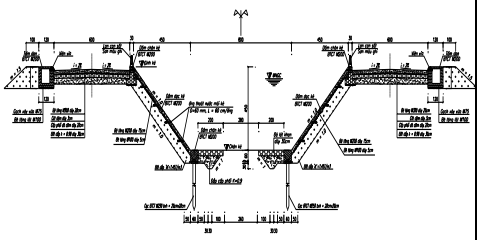
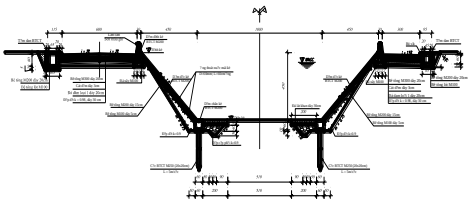
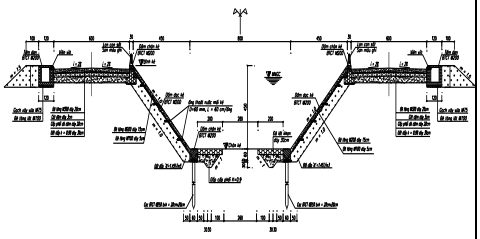
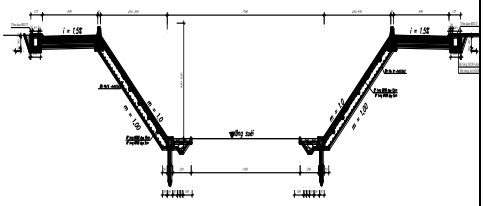
Items	Option 1 – Lakes 2,3	Option2 – Lakes 2,3
Typical cross section		
Specifications	The embankment root is constructed by gravity concrete M150, expected height of 2m. + Embankment body is placed with gravity concrete M200, 15cm thick, full drainage system; +Embankment peak: Combined as transport road and operation management road. (i) Roadway width: 3.5m; (ii) Pavement structure: Top-down pavement structure as follows: Concrete M300, 20cm thick, cross slope 2%, under the concrete layer, there is an aggregate layer type 1, 20cm thick, filling soil k=0.98, 30cm thick. (iii) In addition: the road edge is planted with trees for landscape and designed with accompanying drainage system and lighting system (iv) Install rain drainage system along the embankment of the lake, plant trees and arrange lighting system as appropriate.	The re-inforced concreteslope wall. The wall bottom is consolidated by reinforced concrete piles M300, dimension 25x25. The road in embankment peak is similar to Option 1.
Technical advantages	- This is common option, taking full use of local materials and common workers. - Simple technique and quick construction. - Suitable to various terrains with low difference of height, small flow velocity and stable water level. - Low cost.	- Save the area; - High aesthetics.
Technical disadvantages	- Less aesthetic	- Complicated method of construction that requires high-qualified manpower, modern

Items	Option 1 – Lakes 2,3	Option2 – Lakes 2,3
		plant and equipment, so it fails to take full use of local common workers. - High construction cost
Economic aspect	- Lower construction cost	- Higher construction cos
Environment	- Increase the fresh water reserve capacity for Nam Cuong ward; - Increase the air-conditioning capacity, micro-climate and develop ecological environment; - Enhance drainage capacity for various areas of Nam Cuong, Hong Ha, Nguyen Thai Hoc wards and reduce the flooding.	- Increase the fresh water reserve capacity for Nam Cuong ward; - Increase the air-conditioning capacity, micro-climate and develop ecological environment; - Enhance drainage capacity for various areas of Nam Cuong, Hong Ha, Nguyen Thai Hoc wards and reduce the flooding.
Social aspect	- Only one household is affected, no household is relocated to the resettlement area; the affected area is approximate 300 m^2. - Improve the local people's living conditions. - Form an ecological area of the city. - Balance air and water for the Northwest of the City. - 100% of people and authority agree with and support the project.	- Only one household is affected and no household is relocated to the resettlement area; the affected area is approximate 300 m^2. - Improve the local people's living conditions. - Form an ecological area of the city. - Balance air and water for the Northwest of the City. - 100% of people and authority agree with and support the project.
Selection	From the premarily comparison in the above table and the actual characteristics of the flow in the lake beds with small velocity, quite stable water level and insignficant difference between lake bank and bottom height, **Option 1** is proposed to be selected as the design option.	

Comparison of design options for embankment of Khe Dai stream:

Table 22: Selection of design options for embankment of Cau Dai stream (Khe Dai)

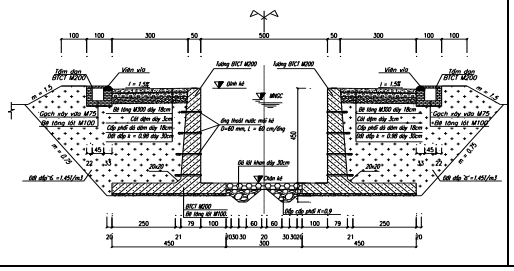
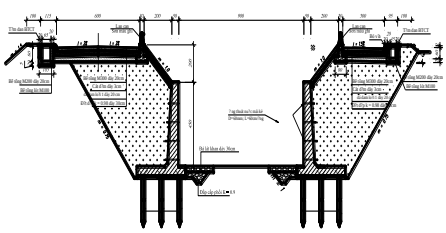
Items	Option 1 – Khe Dai stream	Option 2 – Khe Dai stream
Specifications	- Stream bed: dredge the bed with avarage width of 8m (section 1) 15m (section 2). - Embankment peak altitude from 30.06 – 34.09m - Protection of stream bank with structure: slope embankment. + Embankment root: protect the embankment root by reinforced concrete piles M250, the pile cap is pulled by reinforced concrete M200. + Embankment slope: Slope is protected by concrete M200, 15cm thick, under which, there is a concrete layer M100, 5cm thick, filling soil k=0.95, and on the slope, the ochna-shape hole is designed; + Embankment peak: Arrange transport roads in the two sides, with roadway of 6m wide and with water collection ditches.	- Stream bed: dredge the bed with avarage width of 15m. - Embankment peak altitude from 30.06 – 34.09m - Protection of stream bank with structure: slope embankment. + Embankment root: protect the embankment root by reinforced concrete piles M250, 4.5m wide and in every interval of 11.8m, a settlement joint is arranged. + Embankment wall: upright wall with reinforced concrete R200#. The peak is 0.5cm wide; the root is 1m wide; 11.8m long/ 1 unit; Structure of embankment roof for one unit 11.8m. + Embankment peak: Arrange transport roads in the two sides, with roadway of 6m wide. Top-down pavement structure as

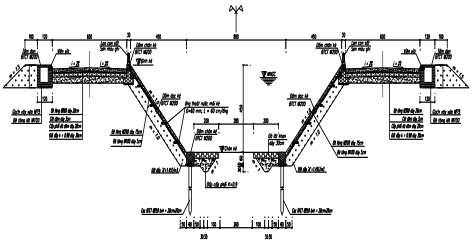
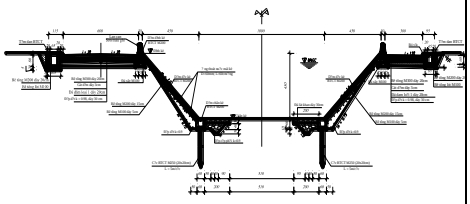
Items	Option 1 – Khe Dai stream	Option 2 – Khe Dai stream
	Top-down pavement structure as follows: Concrete M300, 20cm thick, cross slope 2%, under the concrete layer, there is an aggregate layer type 1, 20cm thick, filling soil k=0.98, 20-30cm thick. In addition, underpass system is developed over the stream; the roads are constructed on the two side of embankement. + Design 06underpasses, each has length of 15m (section 1) and 03 bridges with length of 25m for each (section 2); + Design 17 drainage culverts + Install rain drainage system along the embankment of the lake, plant trees and arrange lighting system as appropriate.	follows: Concrete M300, 20cm thick, cross slope 2%, under the concrete layer, there is an aggregate layer type 1,5cm thick. In addition, underpass system is developed over the stream; the roads are constructed on the two side of embankement. + Design10underpasses, each has length of 25m; + Design 25 drainage culverts; + Install sewage collection culvert HDPE DN200-300 along the embankment bank of two sides of the stream.
Typical cross section – section 1		
Typical cross section – section 2		
Pros and cons	**Pros:** - Good flooding drainage capacity - Suitable to the geologic and terrain conditions in Khe Dai stream. - Volume of digging and filling is not high - The structure of existing works is more convenient. **Cons:** - Acquired area is quite huge	**Pros:** - Improve the flooding drainage capacity - Minimize land acquisition **Cons:** - Flooding drainage capacity is not good
Economic aspect	- Lower construction cost	- Higher construction cost
Environment	- Increase drainage capacity for Minh Tan, Dong Tam and Yen Ninh wards - Improve the environmental hygiene, local people's living conditions along the stream and enahnce the urban landscape.	- Increase drainage capacity for Minh Tan, Dong Tam and Yen Ninh wards - Improve the environmental hygiene, local people's living conditions along the stream and enahnce the urban landscape.
Social aspect	- 107 households are affected, in which26 households are relocated to the resettlement area; the affected area is about 103 993m^2.	- 90 households are affected, in which 26 households are relocated to the resettlement area, the affected area is about 95 879m^2 - Increase the accessibility, development of trading and services;

Items	Option 1 – Khe Dai stream	Option 2 – Khe Dai stream
	- Increase the accessibility, development of trading and services; - Improve the local people's living conditions. - Reduce the damage due to flooding and landslide in the stream banks. - Stabilise the people's lives with their houses and works degraded. - 100% of people and authority agree with and support the project.	- Improve the local people's living conditions. - Reduce the damage due to flooding and landslide in the stream banks. - Stabilise the people's lives with their houses and works degraded. - 100% of people and authority agree with and support the project..
Selection	**Option 1** proposed to embankment of Khe Dai stream is suitable to the flooding drainage capacity and prescribed requirements of structures and other criteria.	

Comparison of design options for embankment of Hao Gia stream:

Table 35: Design options for embankment of Hao Gia stream

Items	Option 1 – Hao Gia stream embankment	Option 2 –Hao Gia stream embankment
Specifications	The embankment with upright wall, reinforced concrete structure M250, applied to the positions going through the residential areas. The embankment wall is 4.5m high; wall body is designed with ochna-shaped pressure-reduced water drainage holes; soil is filled in the mid-wall with compaction k=0.95. Embankment peak isarranged with transport roads in the two sides, with roadway of 3m wideand with water collection ditches. Top-down pavement structure as follows: Concrete M300, 20cm thickcross slope 2%, under the concrete layer, there is an aggregate layer type1, 20cm thick, filling soil k=0.98, 30cm thick.	Slope embankment, the root is supported by reinforced concrete piles M300, dimension of 20x20cm, 5m long, the beam locking pile cap is made of reinforced concrete M250, dimension of 20x25cm. The embankment slope is paved with concrete M200, 15cm thick, coated with concreted M100, designed with drainage system by plastic pipe d=5cm. The embankment peak is designed with concrete roads, the road in the left side is 6m wide, the road in the right side is 3m wide. Top-down pavement structure as follows: Concrete M300, 20cm thickcross slope 2%, under the concrete layer, there is an aggregate layer type1, 20cm thick, filling soil k=0.98, 30cm thick.
Typical cross section – section 1		

Items	**Option 1 – Hao Gia stream embankment**	**Option 2 –Hao Gia stream embankment**
Typical cross section – section 2		
Pros and cons	**Pros:** - Good flooding drainage capacity - Suitable to the geologic and terrain conditions in Hao Gia stream - Volume of digging and filling is not high - Connect with the existing works in a more convenient way. **Cons:** - Acquired area is quite huge	**Pros:** - Improve the flooding drainage capacity - Minimize land acquisition **Cons:** - Flooding drainage capacity is not good
Economic aspect	- Lower construction cost	- Higher construction cost
Environment	- Increase drainage capacity for Dong Tam and Yen Ninh wards - Improve the environmental hygiene, local people's living conditions along the stream and enahnce the urban landscape.	- Increase drainage capacity for Dong Tam and Yen Ninh wards - Improve the environmental hygiene, local people's living conditions along the stream and enahnce the urban landscape.
Social aspect	- 100 households are affected, in which 34 households are relocated to the resettlement area; the affected area is about 21 523m^2. - Increase the accessibility, development of trading and services. - Improve the local people's living conditions; - Creating urban landscape; - Reduce the damage due to flooding and landslide in the stream banks; - Stabilise the people's lives with their houses and works degraded. - 100% of people and authority agree with and support the project..	- 75 households are affected, in which 34 households are relocated to the resettlement area; the affected area is about 14 877m^2. - Increase the accessibility, development of trading and services; - Improve the local people's living conditions; - Creating urban landscape; - Reduce the damage due to flooding and landslide in the stream banks; - Stabilise the people's lives with their houses and works degraded; - 100% of people and authority agree with and support the project.
In addition, along the embankment:	+ Design 6 slab bridges; + Design 14 drainage culverts, concrete culvert M250. + Install rain drainage culvert system, plant trees and arrange lighting system along the roads in the two sides of embankment.	
Selection	**Option 1** is suitable to the good flooding drainage capacity and prescribed requirements of structures and has convenient connection with the existing works.	

(2) Scale and effiency of transport roads:

Determination of the scale, efficiency, function and tasks of the roads is based on the calculation result of traffic volume forecast model. Based on the interviewed and surveyed data, vehicle-counting in some cross sections having influence on the transport volume of the researched region and the socio-economic development senarios, STRADA software is used to develop the arising model and attract the trips (G/A), model OD, method and distribution of road transportation.

From the traffic surveys in the researched area and development orientations as well as planning of Yen Bai city, the research group developed table of arising demand-attraction of road trips in inter-communes in expanded Yen Bai city. Then, we develop the flow of commodity, traveller flow in expanded Yen Bai city.

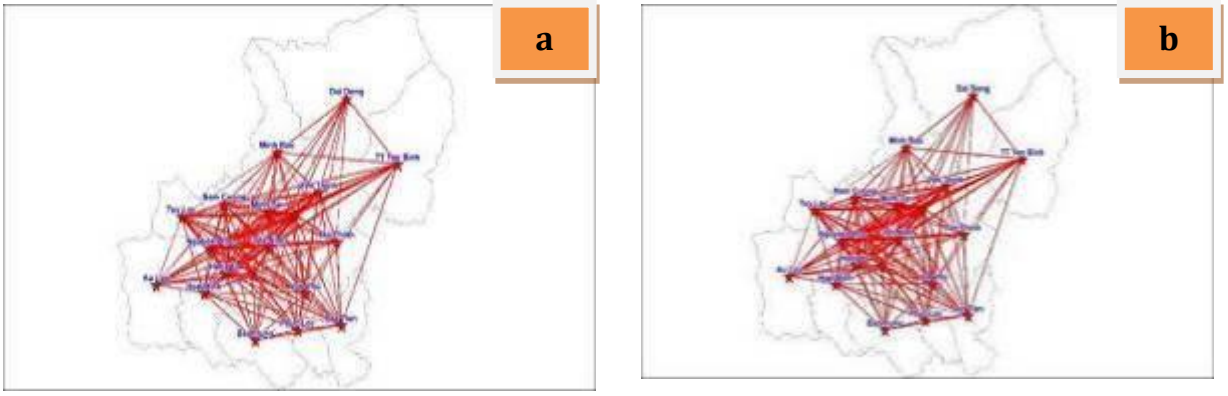


Figure 32: Diagram of road traveller flow in Yen Bai (not expanded)

2020 (a) and 2025 (b)

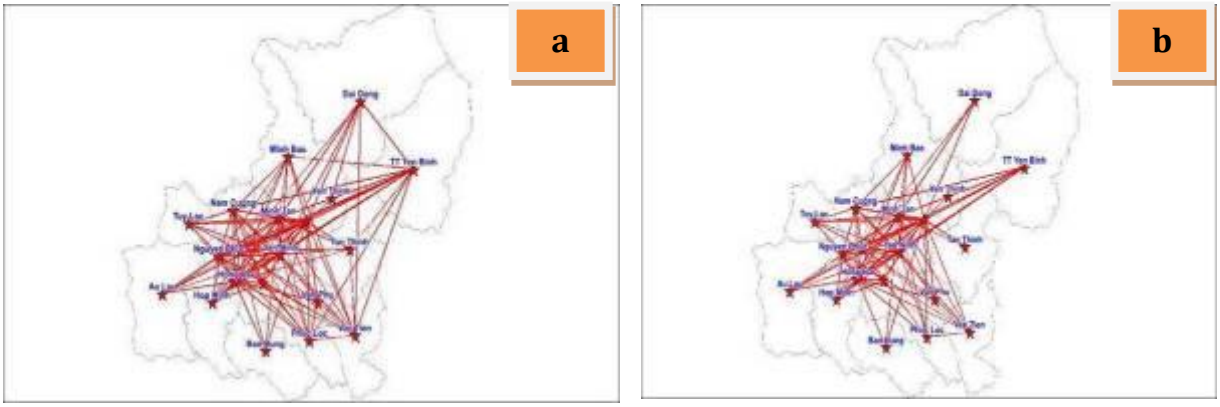


Figure 32: Diagram of road traveller flow in Yen Bai (not yet expanded)

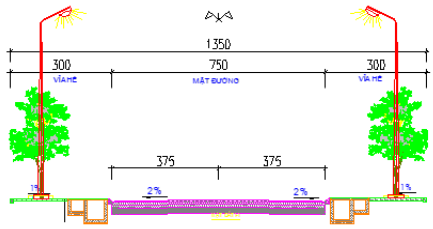
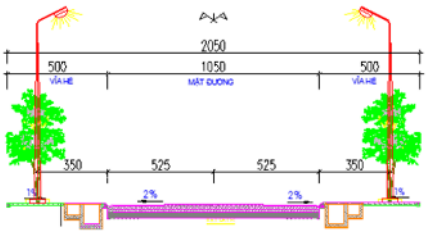
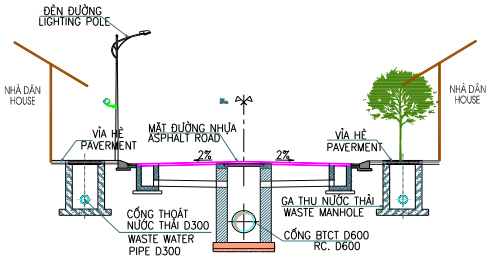
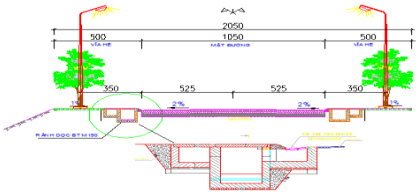
2020 (a) and 2025 (b)

After the assessment of the imitating model, the road vehicle density in three proposed roads is appropriate, including the roads from Dien Bien road to the road connecting Bach Lam bridge and Van Phu bridge – Road 1; road from Bach Lam bridge to Van Phu bridge – Road 2 and road from Nguyen Tat Thanh intersection to Au Co intersection – Road 3. However, after the sub-project is completed, the density of traffic vehicles on three roads in question will be reduced and distributed to the routes.

Then, the design options for the roads are evaluated for selection in the following table:

Options for Road no.1 is as follows:

Table 36: Design option for rhe road from Dien Bien road to the road from Bach Lam bridge to Van Phu bridge

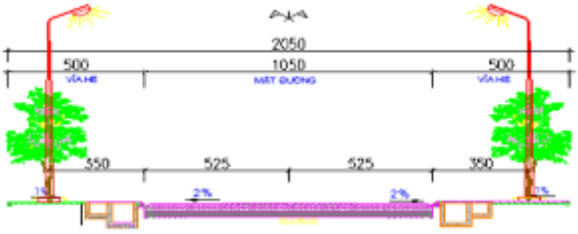
Items	Option 1	Option 2
Typical cross section		
Drainage system	 *Using a separate drainage culvert system*	 *Using a common reinforced concrete drainage culvert system*
Description	According to the master planning of Yen Bai city: Roadway width : 7.50m Pavement width : 2x3.00 = 6.00m ankment width : 13.5m Rainwater and wastewater will be collected by two seperate pipe lines.	According to the master planning: Roadway widthmặt đường : 0.50m Pavement width : 2x5.00 = 10.00m Embankmentwidthđường : 20.5m Rainwater and wastewater will be collected by a common reinforced concrete pipe.
Specifications	- Roadway area: 8,290 m2 - Digging and filling volume: 145,708 m3 **Pros:** - Suitable to the urban road standards; - Suitable to themaster planning of the city; - Digging and filling volume is not big; - Life circle of drainage system is higher; - Not cause odour from the separate drainage system; - Easy management and operation; - People will not be suffered from flooding and the diseases due to environmental pollution will be also reduced. **Cons:** -Small area of sidewalk, which is difficult to arrange the works and difficult for walking.	- Roadway area: 12,502 m2 - Digging and filling volume: 254,398 m3 **Pros:** - Suitable to the urban road standards; - Have wide sidewalk for arrangement of infrastructure works; - Avoid traffic jam in the future; - The local materials are available; - Suitable to the local drainage system; - Easily and conveniently connected with other culverts; - Easily connected to the household; - People will not be suffered from flooding and the diseases due to

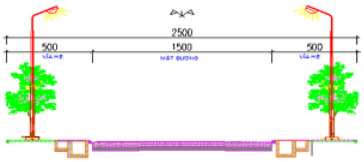
Items	Option 1	Option 2
	- The road is not aesthetic. - The traffic jam may occur in the near future due to small scale; - The city has not had its own drainage system, which causes difficulties in connection; - Total length of pipe line is higher; - Construction volume is higher.	environmental pollution will be also reduced. **Cons:** - Digging and filling volume is bigger than Option 1. - Easily flooded when the wastewater volume is big. - Not comply with environmental sanitation because of the odour emitted from the surface water collection gates.
Social aspect	**Pros:** - Improve the local people's living conditions; - Travel time from the left bank to the right bank of the Red river is shorter; - Reduce the traffic accidients; - 20% of people agree with Option 1. **Cons:** - Number of affected households: 18 - Number of households subject to resettlement: 04 - Affected area: 12.05 ha - In the near future, this road will be easily jammed, causing difficultites in movement and development along the route.	**Pros:** - Improve the local people's living conditions; - Travel from the left bank to the right bank of the Red river is faster and more convenient; - Reduce the traffic accidients. - **80%** of people agree with Option 2. **Cons** - Number of affected households: 22 - Number of households subject to resettlement: 04 - Affected area: 18.31ha
Environment	**Pros:** - Improve the environment; the flooding will not exist and odour will not be available because the wastewater is collected. - Mitigate the environmental pollution caused by odour from wastewater. **Cons:** - It is easy to happen that people do not connect their wastewater pipe line to the constructed one and they may continue to discharge the wasteward into the lake thus causing pollution.	**Pros:** - Improve the environment; the flooding will not exist. **Cons:** - Easily re-polluted by the odour of wastewater. - High possibility of stagnated wastewater, which may overflow onto the lake because the waste from the pipe line is stagnated for a long time.
Economic aspect	- Total construction cost: 52.2 billion dong	- Total construction cost: 64.4 billion dong
Selection	Selection of option: propose to select**Option 2**as the design option whichsatisfies the technical design requirements and desire of the people in increasing the urban connectivity for attracting and encouraging trade, service and investment in the coming time.	

Options for road no.2 is as follows:

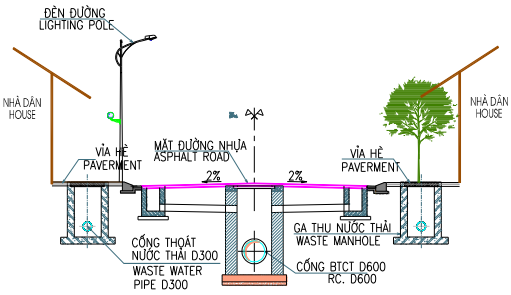
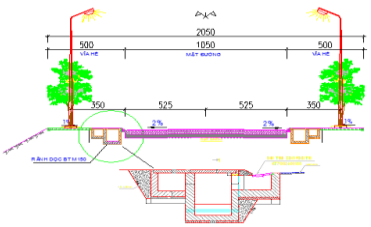
Table 37: Design option for Road No.2 - road from Bach Lam bridge to Van Phu bridge

<table>
<tr><th>Items</th><th>Option 1</th><th>Option 2</th></tr>
<tr><td>Cross section</td><td> 

Section 1: From Bach Lam bridge to Tuan Quan bridge


Section 2: From Tuan Quan bridge to Van Phu bridge</td><td> 
</td></tr>
<tr><td>Description</td><td>According to the master planning, transport planning of the province:

Section 1 Section 2
Roadway width : 15 m 10.50m
Pavement width : 2x5.00 = 10m x5.00 = 10
Embankment width : 25m 20.5 m</td><td>According to the adjusted master planning:

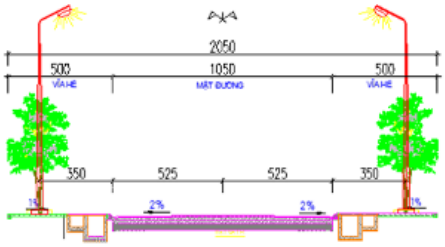
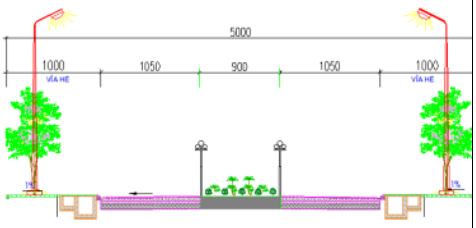
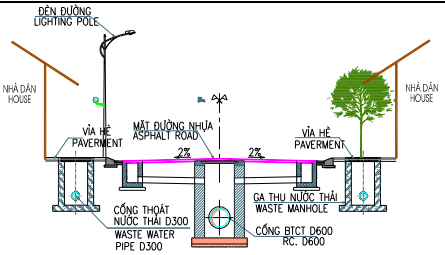
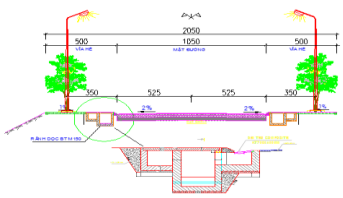
Roadway width 15 m
Pavement width 5 = 10.00m
Embankment width : 25 m</td></tr>
<tr><td>Drainage system</td><td> 
</td><td> 
</td></tr>
</table>

Items	**Option 1**	**Option 2**
Specifications	- Roadway area: 49,376 m^2 - Digging and filling volume: 983,047 m^3 **Pros:** - Suitable to the urban road standards; - Suitable to themaster planning of the cityand transport planning of Yen Bai province; - Digging and filling volume is not big. **Cons:** - The landscape of the road is not nice because along the route there are two scales of road.	- Roadway area: 62,716 m^2 - Digging and filling volume: 1,049,745 m^3 **Pros:** - Suitable to the urban road standards; - Nice landscape. **Cons:** - Digging and filling volume is bigger than Option 1.
Social aspect	**Pros:** - Improve the local people's living conditions. - Travel along the Red river and rescue in the flooding season are faster and more convenient. - Reduce the traffic accidients. - 90% of people agree with the new road construction project **Cons** - Number of affected households:97 - Number of households subject to resettlement: 54 - Affected area: 33,8 ha.	**Pros:** - Improve the local people's living conditions. - Travel along the Red river and rescue in the flooding season are faster and more convenient. - Reduce the traffic accidients. The local people do not agree with this option because the volume of land acquisition is huge. **Cons** - Unsuitable to the orientation and planning - Number of affected households: 137 - Number of households subject to resettlement: 75 - Affected area: 48,9 ha.
Cost	- Construction cost: 124.3 billiong dong	- Construction cost: 162,3 billion dong
Environment	**Pros:** - The environment is improved; the flooding will not exist and odour will not be available because the wastewater is collected. - Mitigate the environmental pollution caused by odour from wastewater. **Cons:** - It is easy to happen that people do not connect their wastewater pipe line to the constructed one and they may continue to discharge the wasteward into the lake thus causing pollution.	**Pros:** - The environment is improved; the flooding will not exist. **Cons:** - Easily re-polluted by the odour of wastewater. - High possibility of stagnated wastewater, which may overflow onto the lake because the waste from the pipe line is stagnated for a long time.

Items	Option 1	Option 2
Option	Option: propose to select **Option 1** as the design option because it is suitable to the urban planning and desire of the local people.	

Options for Road no.3 is as follows:

Table 38: Design option for Road no.3 –road from Nguyen Tat Thanh intersection to Au Co intersection

Items	Option 1	Option 2
Typical cross section		
Description	According to the adjusted master planning of Yen Bai city: Roadway width: 10.50m Pavement width: 2x5.00 = 10m Embankment width: 20.5 m	According to the master planning of Yen Bai city: Roadway width: 2 x 10.5 =21.00 m Median strip: 9.00m Pavement width: 2 x 10 = 0.00 Embankment width 50 m
Typical cross section of drainage system	 *Using a separate drainage culvert system*	 *Using a common reinforced concrete drainage culvert system*
Specifications	- Roadway area: 40,201 m^2 - Digging and filling volume: 1,072,307 m^3 **Pros:** - Suitable to the urban road standards - Digging and filling volume is not big - Suitable to the urban development - Suitable to the calculated traffic volume **Cons:** - The landscape of road is not nice.	- Roadway area: 88,200 m^2 - Digging and filling volume: 2,311,370 m^3 **Pros:** - Suitable to the urban road standards - Road size is wide, satisfying the master planning - The beginning and ending points of the route (Nguyen Tat Thanh street, Au Co street), have same size, so the connection and management in the future will be easier. **Cons:** - Digging and filling volume is toot big - Unsuitable to the conditions and transport need of the city

Items	Option 1	Option 2
Social aspect	**Pros:** - Improve the local people's living conditions. - Travel from the center to other areas is more convenient - Reduce the traffic accidients. - Form the urban development corridor in the Southeast of the City. **Cons** - Unsuitable to the orientation and planning of the City. - Number of affected households: 36 - Number of households subject to resettlement: 17 (including the seperation of households and stand-by) - Affected area: 16.17 ha - 100% of people agree with Option 1	**Pros:** - Improve the local people's living conditions. - Travel from the center to other areas is more convenient. - Reduce the traffic accidients. - Form the urban development corridor in the Southeast of the City. **Cons:** - The scale is large, accordingly, a great number of households must be relocated thus affecting their livehood. - Number of affected households: 86 hộ - Number of households subject to resettlement: 41 HHs - Affected area: 33.1 ha People do not agree with Option 2 because of the significant impact from the land acquisition
Economic aspect	Costruction cost: 139.8 billion dong	Costruction cost: 335.7 billion dong
Environment	**Pros:** - The environment is improved; the flooding will not exist and odour will not be available because the wastewater is collected. - Mitigate the environmental pollution caused by odour from wastewater. **Cons:** - It is easy to happen that people do not connect their wastewater pipe line to the constructed one and they may continue to discharge the wasteward into the lake thus causing pollution.	**Pros:** - The environment is improved; the flooding will not exist. **Cons:** - Easily re-polluted by the odour of wastewater. - High possibility of stagnated wastewater, which may overflow onto the lake because the waste from the pipe line is stagnated for a long time.
Selection	Option: From the above comparison results, **Option 1** is proposed to be selected as the design option because it is suitable to the urban development demand and calculation of transport volume in the region**.**	

In short, the assessment of design option conducted on the basis of technical, social, environment and economic criteria helps to select the design options for Nam Cuong lake, Hao Gia, Khe Dai streams and 3 roads proposed in the sub-project.

(1) Resettlement sites:

The selection of constructing 5 resettlement sites for the households subject to relocation due to the impact by the sub-project has been conducted with consultation in two times (April-May

2017 and August-September 2017). The detailed criteria are as follows: (i) locations of the resettlement areas are situated in compliance with the development planning of the City in avoidance of overlapping the land use planning; (ii) the areas are adjacent to the present living area of the households and their fields, gardens, production areas, etc and their land use area; (iii) It is assured to have consulted with the affected households and acknowledged their desire to live in the resettlement, (iv) the resettlement areas are convenient in traffic, commercial intercourse and daily activities for the affected people. And five resettlement areas have been selected and agreed by the relocated/resettled households in Yen Ninh ward, Van Phu and Tan Thinh Commue.

The details of environmental and social impacts when these work items are implemented will be presented in Chapter 4 hereunder.

CHAPTER 4. ENVIRONMENTAL-SOCIAL IMPACT ASSESSMENT

Yen Bai Sub-project includes Component 1: Strutural solutions – Urban technical infrastructure rehabilitation and construction, including the following work items:

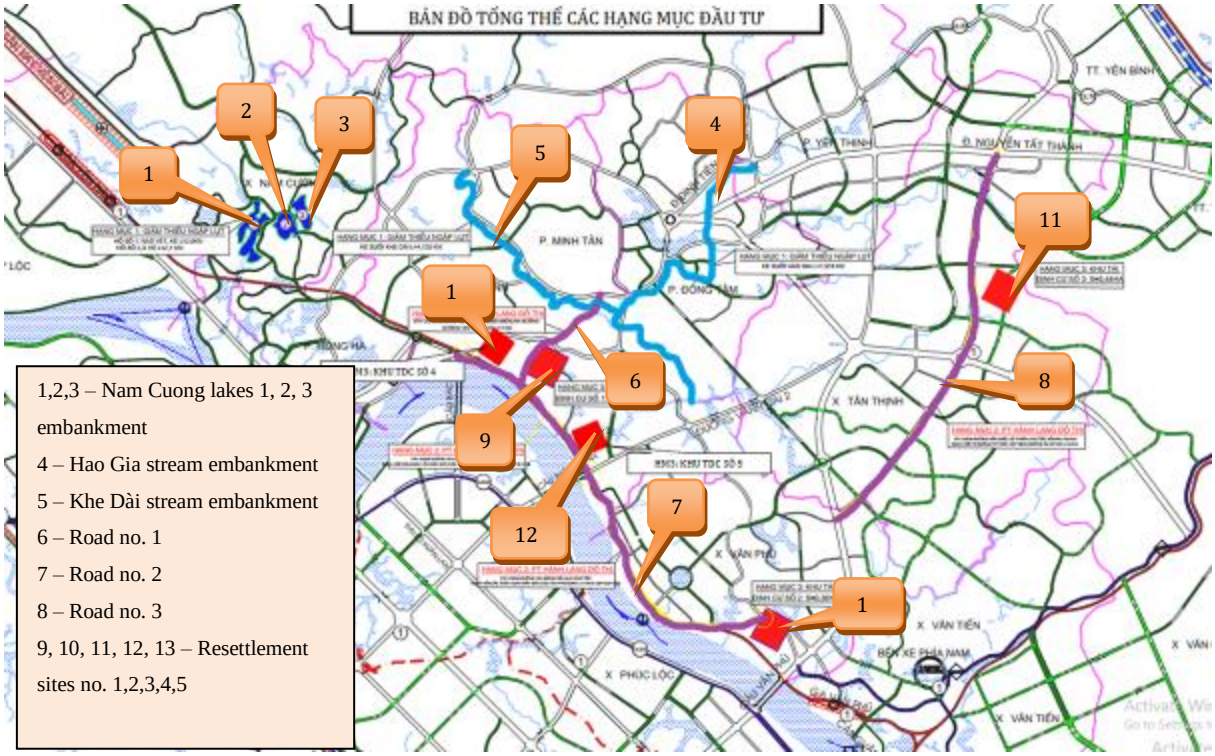


Figure 34: Sub-project's investment items

Main rehabilitation and construction items include:

1. Dredging and embankment construction of lake 1: L=2,365 m, average dredging depth 0.5 m
2. Construction of lake 2 embankment: total length L=840 m
3. Construction of lake 3 embankment: total length L=1,041 m
4. Construction of Hao Gia stream flood control embankment, total length L=1,510m
5. Construction of Cau Dai stream flood control embankment, total length L=3,755m
6. Construction of a road from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge L= 1,035 m (road no.1).
7. Construction of a road connecting Bach Lam bridge to Van Phu bridge L=4,678 m (road no.2)
8. Construction of a road from Nguyen Tat Thanh road to Au Co road L=4,200 m (road no.3)

9. Construction of resettlement site no.1 in Yen Ninh ward in an area of 1.6ha
10. Construction of resettlement site no.2 in Van Phu commune in an area of 0.37ha
11. Construction of resettlement site no.3 in Tan Thinh commune in an area of 0.44ha
12. Construction of resettlement site no.4 in Yen Ninh ward in an area of 0.40ha
13. Construction of resettlement site no.5 in Yen Ninh ward in an area of 0.30ha.

4.1. POSITIVE IMPACTS

The sub-project with the work items of lake and stream embankment construction, construction of roads and resettlement sites, upon their completion, is expected to produce enormous social, environment, economic impacts as well as trade and investment opportunities, whereby promoting the overall socio-economic development of Yen Bai city, Yen Bai Province and the region. Specifically:

1. Urban infrastructure and regional communication and connectivity improvement: the construction of roads no. 1,2,3 will:

- Improve the embankment infrastructure and rainwater drainge system, develop urban corridors and connecting with key zones, thus developing comprehensive technical infrastructure.
- Take full advantage of Noi Bai – Lao Cai expressway and NR37, facilitating the travel, trading, socio-economic growth and enhancing living conditions for people adjacent to the roads.

2. Urban landscape improvement: Hao Gia stream, Khe Dai stream and 3 Nam Cuong lakes embankment construction will:

- Create a complete urban picture by changing and rehabilitating urban emvironment and landscape;
- The embankment construction will beautify the landscape and create local micro-climate conditions;
- The construction of stretching and spacious roads will create modern urban landscape;
- The bridges connecting the regions will be the extended hands that support the urban development;
- The embanked reservoirs will act as wells that both store freshwater and regulate flood water and create a clean environment, sustaining the local eco-system.

3. Environmental sanitation and health improvement: Hao Gia, Khe Dai stream and 3 Nam Cuong lakes embankment construction will:

- Reduce flooding from 0.5 to 0.7m, speed up drainage;

- The embankment on Nam Cuong lakes and Hao Gia, Khe Dai streams will provide spaces for people to do exercices and organise public activities, etc.
- Control epidemics thanks to lower flooding depth, frequency and time, and reasonable arrangement of garbage gathering points.
- Prevent encroachment on the flow, partlly control flooding in the upper-stream and in the residential areas along the Cau Dai, Hao Gia streams and Nam Cuong lakes no. 1,2,3.
- Create clean and spacious urban spaces free of flooding and pollution, facilitating epidemic control and health improvement for local residents.

4. Socio-economic efficiency*:* The construction of Hao Gia, Khe Dai stream and 3 Nam Cuong lakes embankment and roads no. 1,2,3 will:

- Reduce economic losses from flooding and medical costs...
- Create sizeable land areas for arragement of resettlement sites for households whose land is acquired for the project.
- Increase value of surrounding land, especially land adjacent to the roads, by construction of roads, embankments and resettlement sites.
- Intensify the access to basic infrastructure services, paving the way for integration, investment and business.
- Increase job opportunities and incomes, thus alleviating urban poverty.
- Stimulate purchase demands, promote trade and services and accelerate socio-economic development in the city and the province.
- Ensure stable livelihood for local people and organisations as well as the compliance with the city's economic development orientations and masterplan for upgrading the city to grade II by 2020.

For the above reasons, the Dynamic Cities Integrated Development Project, Yen Bai city, Yen Bai Province Sub-project, funded by World Bank is a highly feasible project with enormous socio-economic and environmental effects for Yen Bai city in particular and the entire Midlands and mountainous areas in the North Central region of the country. However, apart from the above-mentioned positive impacts, the execution of the sub-project's work items will cause negative impacts during the preparation, execution and operation stages. These impacts are temporary, short-term and controllable by means of impact mitigating measures.

4.2. ASSESSMENT AND FORECAST OF NEGATIVE IMPACTS AND RISKS

4.2.1 Degree of impacts

Types and scales of potential negative environmental impacts of the sub-project's components are summarised in the table below. The potential impacts of the sub-project's components are categorised as follows: None (N) No impact; low impact (L) – small works, small, local, revertable, temporary impacts; medium (M) - small works in urban/sensitive areas, of medium scale with moderate, local, revertable, temporary impacts; high (H) – large-scale works in urban/sensitive areas with considerable irrivertible and indemnificable impacts (on society and/or environment).

Overall, all the activities of the work items of the Yen Bai City sub-project involve the execution of medium and small size works, most of the negative environmental impacts are changeable, temporary, local and minimizeable by taking appropriate management measures, close supervision of the contractor's operations and local community consultation. However, types and nature of the impacts vary significantly as per the nature and scale of the activities, locations, socio-economic conditions, people's habits and time.

Table 23: Degree of negative impacts caused by the execution of the sub-project's work items

Items	*Physical*			*Biological*		*Social*				*Others*		*Remarks*
	Air, noise, vibration	*Soil, water*	*Solid waste, dredged sludge*	*Natural forest and eco-system*	*Fish, aqua products*	*Land acquisition, resettlement*	*Indigenous people*	*Tangible cultural resources*	*Livelihood, disruptions to the communities*	*Local flooding, transport, safety*	*Impacts outside the project area*	
1. Nam Cuong lakes 1, 2, 3, Hao Gia and Khe Dai stream embankment construction: - Nam Cuong lake 1 embankment with the respective lengths of 2,365m, 850m and 1,041m: affecting 12 HHs, no HH is to be relocated and resettled. Total affected land area: 8.401 m2. Where: Homestead land: 270 m2; Agricultural land: 3,045 m^2; Land under commune PC's management: 5,086 m^2 - Nam Cuong lake 1 embankment with the respective lengths of 2,365m, 850m and 1,041m: no affected land and HH. - Nam Cuong lake 1 embankment with the respective lengths of 2,365m, 850m and 1,041m: no affected land and HH. - Hao Gia stream embankment in a length on each side of 1,510m, 78 directly affected HHs, 01 indirectly affected HH, affected land area: 21,533 m^2. Where: Homestead land: 6,731 m^2; Agricultural land: 12,359 m^2, including 3,190m2 of production forest land; Land under commune PC's management 273 m^2 - Hao Gia stream embankment in a length on each side of 3,755 m. 199 directly affected HHs, 17 indirectly affected HHs; 28 HHs are to be relocated and resettled; Affected land area: 112,994 m^2. Where: Homestead land: 7,567 m^2; Agricultural land: 82,294 m^2, including 31,344m^2 of production forest land; Land under commune PC's management 10,279 m^2. - Affect agricultural land. - Affect water quality in the construction sites of the sub-project's work items. - Affect traffic on Yen Ninh, Thanh Cong, Tran Binh Trong, Nguyen Thai Hoc, Dien Bien, 70, Nguyen Tat Thanh roads. - Affect local festivals and cultural practices - Affect local people's living.												
Preparation	L	L	M	N	L	M	N	N	M	L	N	- Small and medium size works with small impacts (refer to note (2) hereunder for more details)
Construction	M	M	L	N	L	N	N	N	M	M	L	
Operation	N	N	L	N	N	N	N	N	N	N	N	
2. Bridges on Hao Gia embankment (6 bridges, each is 15m long) and Khe Dài stream (9 bridges, each is 15m long), bridge on road no. 1 (each is 15m long) and bridge on road no.3 (each is 12m long) - Compensation for bridges has been included in the compensation for Hao Gia and Khe Dai streams embankment as mentioned above; - Affect local people's living; - Affect local HHs' travel during the construction period; - Affect water quality in the construction site.												
Preparation	L	L	L	N	N	L	N	N	N	N	N	- Small and medium size works with small impacts (refer to note (2) hereunder for more details)
Construction	L	L	L	N	N	N	N	N	N`	L	N	
Operation	N	N	N	N	N	N	N	N	N	N	N	
3. Road: dimensions 10.5m + 2x5m = 20.5m												

Items	*Physical*			*Biological*		*Social*				*Others*		*Remarks*
	Air, noise, vibration	*Soil, water*	*Solid waste, dredged sludge*	*Natural forest and eco-system*	*Fish, aqua products*	*Land acquisition, resettlement*	*Indigenous people*	*Tangible cultural resources*	*Livelihood, disruptions to the communities*	*Local flooding, transport, safety*	*Impacts outside the project area*	
- Road from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge (road no. 1): 1,035m long. Affecting 47 HHs, 11 HHs to be relocated and resettled. Affected land area: 18,319 m2. Where: Homestead land: 2,758 m2; Agricultural land: 11,196 m2, including 9,923m2 of production forest land; Land under commune PC's management: 4,635 m2 - Road connecting Bach Lam bridge to Van Phu bridge (road no. 2): 4,678m long, 310 HHs directly affected, 26 HHs indirectly affected, 44 HHs to be relocated and resettled; Affected land area: 268,662 m2. Where: Homestead land: 12.728 m2; Agricultural land: 211,714 m2, including 124,545m2 of production forest land; Land under commune PC's management: 38,507 m2; - Road from Nguyen Tat Thanh intersection to Au Co intersection (road no. 3): 4,200m long. 136 HHs directly affected, 5 HHs indirectly affected, 9 to be relocated and resettled; Affected land area: 161,749 m2. Where: Homestead land: 6,073 m2; Agricultural land: 152,334 m2, including 76,347m2 of production forest land; Land under commune PC's management: 3,342 m2. - Affect local people's living; - Affect agricultural production; - Affect traffic on Nguyen Thai Hoc, Ho Xuan Huong, 70, Dien Bien, Au Co, Nguyen Tat Thanh roads and inter-group and inter-hamlet roads in the sub-project area due to waste material transportation and disposal.												
Preparation	L	L	L	L	L	M	N	L	L	L	L	- Small and medium size works with small impacts (refer to note (2) hereunder for more details)
Construction	L	L	L	L	L	N	N	N	N	N	N	
Operation	N	N	N	N	N	N	N	N	N	L	N	
4. Resettlement - Resettlement site no. 1 in group 26, Yen Ninh ward, 10 HHs directly affected, 8 HHs indirectly affected, no HHs to be relocated and resettled; Affected land area: 16,000 m2. Where: Homestead land: 0 m2; Agricultural land: 12,058 m2; Land under commune PC's management: 3,942 m2. - Resettlement site no. 2 in Van Lien hamlet, Van Phu commune. 9 HHs directly affected, 3 HHs indirectly affected, no HHs to be relocated and resettled. Affected land area: 3,652 m2. Where: Homestead land: 0 m2; Agricultural land: 1,420 m2; Land under commune PC's management: 2,054 m2. - Resettlement site no. 3 in Luong Thinh 3 hamlet, Tan Thinh commune. 7 HHs directly affected, 11 HHs indirectly affected, no HHs to be relocated and resettled; Affected land area: 4,406 m2. Where: Homestead land: 0 m2; Agricultural land: 2,473 m2; Land under commune PC's management: 1,933m2 - Resettlement site no. 4 in groups 6,7 in Yen Ninh ward. No HHs to be relocated and resettled. Affected land area: 3,963 m2. Where: Homestead land: 473 m2; Agricultural land: 2,899 m2; Land under commune PC's management 591 m2 with 16 directly affected and 7 indirectly affected. - Resettlement site no. 5 in group 39 in Yen Ninh ward. No HHs to be relocated and resettled. Affected land area: 3.015 m2. Where: Homestead land: Not affected; Agricultural land: 2.822m2; Land under commune PC's management 193 m2; - Affect agricultural production; - Affect local people's living.												
Preparation	L	L	M	L	N	M	N	N	L	L	N	- Small and medium size works with small impacts (refer to note (2) hereunder for more details)
Construction	M	M	L	L	N	N	N	N	L	L	L	
Operation	M	N	N	N	N	N	N	N	N	N	N	
Notes:												

Items	*Physical*			*Biological*		*Social*				*Others*		*Remarks*
	Air, noise, vibration	*Soil, water*	*Solid waste, dredged sludge*	*Natural forest and eco-system*	*Fish, aqua products*	*Land acquisition, resettlement*	*Indigenous people*	*Tangible cultural resources*	*Livelihood, disruptions to the communities*	*Local flooding, transport, safety*	*Impacts outside the project area*	
(1) The following criteria are used for environmental impact assessment: *None (N) No impact; low impact (L) – small works, small, local, revertable, temporary impact; medium (M) - small works in urban/sensitive areas, of medium scale with moderate, local, revertable, temporary impacts; high (H) – large-scale works in urban/sensitive areas with considerable impacts (on society and/or environment) with many irrivertible and indemnificable cases. Both M and H need supervision and mitigating measures as well as corresponding institutional safety capacity. (2) Medium and small size works, with mostly local and temporary impacts which may be minimized by taking proper technical solutions and management best practices, combined with close supervision, inspection and local community consultation.*											

4.2.2 Pre-construction phase

The sub-project consists of 13 work items, including 5 embankments (15 bridges on the embankments; in which 9 bridges on Khe Dai stream and 6 bridges on Hao Gia stream), 3 roads (including 2 bridges, 1 bridge on the road from Dien Bien road to the road connecting Bach Lam bridge and Van Phu bridge and 1 bridge on the road connecting Nguyen Tat Thanh intersection and Au Co intersection) 5 resettlement sites in 7 wards/communes of Yen Bai city. The execution of the work items (36 months) will cause small to medium short-term impacts and require acquisition of some land areas which scatter in the wards and communes , therefore, they will be executed at the same time. Hence, in the pre-construction– land acquisition phase, only following negative impacts will be discussed: (i) Bomb and mine clearance; (ii) Impacts on cultural facilities and structures, and (iii) social impacts relating to land acquisition and site clearance. The waste generating impacts from dredging and excavation in preparation for the construction will be discussed in the construction phase hereunder.

1. Bomb and mine clearance

The levelling for construction of the work items under the sub-project may be affected by bomb, mine and chemicals left from war time. Subjects of impact include workers on the site, local people and workers involved in the construction of the works. Bomb and mine left from war time may: (i) cause accidents to workers on the site, surrounding people and damage equipment and machinery, and (ii) pose fire and explosion risks that may kill staff or destroy equipment of the demining units. Despite their short-term duration, the demining operations may cause long-term effects on the health and mentality of workers, deminers and local people. However, these impacts may be controlled by means of appropriate methods. Bomb, mine and chemical clearance is, therefore, a compulsory requirement before construction of any work items.

2. Architectural and cultural works

No architectural and cultural works within the construction sites of the sub-project's work items are to be appropriated or directly affected. There is, therefore, not any such impact.

3. Social impacts attributable to land acquisition

Land acquisition and resettlement may affect life and production of local HHs and give rise to other social issues. According to the survey's findings, the execution of 13 work items under the sub-project will affect 992 HHs, in which 938 HHs are indirectly affected and 54 HHs are directly affected from their cultivation on the land under ward/commune PC's management.

400 HHs have affected homstead land, including 297 partially affected HHs[14] and 103 wholly affected HHs[15]. 115 HHs are to be resettled[16], 46 HHs of which are to resettle by themselves and 69 HHs proposed to move the resettlement sites. Socio-economic survey on the resettled HHs shows that a total of 69 HHs will be resettled but 136 resettlement lots must be made available to accommodate for a number of HHs wishing to separate into different HHs (an increase of 67 HHs/ a total of 69 HHs to occupy the resettlement sites). The proposed resettlement sites have been consulted with local people in April-May 2017 and August-September 2017.

Number of resettled HHs is 136, which is a relatively large number. But the survey on the living conditions of the HHs adjacent to the Hao Gia and Khe Dai stream embankment routes found that they were living in a polluted area with limited services and utilities, many of them live in shabby shouses that may collapse at any time due to incessant flooding and inundation, many families with a large number of members are not allowed to separate into different HHs or rebuild their houses, etc.

The HHs adjacent to the Nam Cuong lake embankment, and roads from Bach Lam bridge to Van Phu bridge and from Nguyet Tat Thanh intersection to Au Co intersection are not allowed to carry out new constrution or separate their land to build new houses for their families because they are located within the planned construction boundaries agreed between the government and local people for many years, which cause numerous difficulties and inconvenience to local people's life.

Moreover, the HHs removed to the resettlement sites have known each other and share the same living habits and practices, they are, therefore, friendly and comfortable and they don't need time to get acquainted to the new neighbours with different life styles and customs or to adapt to a new environment.

As such, the arrangement of resettlement sites for HHs wishing to resettle will provide them new dwelling which is large enough and convenient for their families. Hence, despite the

[14] Partially affected HH: The remaining land area after acquisition is enough for the HH to live as stipulated by the Province.

[15] Wholly affected HH: The entire residential land is acquired or the remaining residential land after acquisition is not enough for the HH to live as stipulated by Yen Bai Province.

[16] Resettled HH: HH whose entire or most of the house on their residential land is acquired or affected and the remaining area is not enough for the HH to live or the acquisition affects the main structure of the house, causing its demolition.

disturbance to their lives, this is considered a positive impact for them and the negative impacts are considered as minor and easily managed by the HHs. This is also the objective of the sub-project in designing and arranging resettlement sites in accordance with the HHs' proposal and desire.

Under the sub-project, 240 HHs with less than 20% of agricultural land (< 10% of agricultural land for highly vulnerable HHs) and 752 HHs with more than 20% of agricultural land (from 10% of agricultural land for highly vulnerable HHs). Subjects of impact are HHs in the land acquisition areas, which are mainly rice fields, production forest land, orchards, perennial land or fallow land. Most of agricultural land acquired from HHs produces low yield crops and inefficient cultivation. Therefore, impact level is considered as low and medium. The impacts are insignificant but prolonged after the acquisition. Appropriate measures may be adopted to minimise these impacts.

In general, the impacts from land acquisition and resettlement are inevitable and impacts of relocation and resettlement are from low to medium. The sub-project has prepared a resettlement plan to minimise the impacts from land acquisition and resettlement. Mitigating measures for affected HHs are presented in Resettlement Plan.

Number of HHs and agencies whose land and accompanying properties evicted for the purpose of the sub-project are shown in the table below:

Table 40: Number of HHs affected by land acquisition for the execution of the sub-project[17]

No	Items	Ward/commune	No. of HHs with affected homestead land			No. of HHs to be resettled	Self-resettled (HH)	Concentrated resettlement (HH)			No. of HHs with affected agricultural land (HH)		
			Partial	Whole	Total			No. of HHs	To be separated	Tota	< 20% and < 10% for highly vulnerable HHs	From 20% upwards and 10% upwards for highly vulnerable HHs	Total
1	***Sub-component 1: Flood control and urban safety***		**187**	**32**	**219**	**51**	**20**	**31**	**29**	**60**	**72**	**196**	**268**
1.1	Rehabilitation of 3 Nam Cuong lakes	Nam Cuong	2	0	2	0	0	0	0	0	4	7	11
1.2	Cau Dai stream embankment	Yen Ninh	33	7	40	11	4	7	6	13	21	66	87
		Minh Tan	54	6	60	9	3	6	5	11	14	47	61
		Dong Tam	15	2	17	8	6	2	0	2	6	35	41
1.3	Hao Gia stream embankment	Dong Tam	83	17	100	23	7	16	18	34	27	41	68
		Yen Thinh	0	0	0	0	0	0	0	0	0	0	0
2	***Sub-component 2: Development of urban transport and connectivity enhancement***		**110**	**71**	**181**	**64**	**26**	**38**	**38**	**76**	**120**	**483**	**603**
2.1		Yen Ninh	12	0	12	2	2	0	0	0	6	23	29

[17] Source: Statistics from Resettlement Plan Report of Yen Bai City Sub-project

No	Items	Ward/commune	No. of HHs with affected homestead land			No. of HHs to be resettled	Self-resettled (HH)	Concentrated resettlement (HH)			No. of HHs with affected agricultural land (HH)		
			Partial	Whole	Total			No. of HHs	To be separated	Tota	< 20% and < 10% for highly vulnerable HHs	From 20% upwards and 10% upwards for highly vulnerable HHs	Total
	Road from Dien Bien road to riverside road	Minh Tan	6	4	10	9	5	4	0	4	0	0	0
2.2	Road from Tuan Quan bridge to Van Phu bridge	Van Phu	14	12	26	11	2	9	6	15	19	160	179
		Yen Ninh	52	45	97	33	17	16	23	39	28	118	146
2.3	Road from Nguyen Tat Thanh intersection to Au Co intersection	Tan Thinh	26	10	36	9	0	9	9	18	19	109	128
3	***Sub-component 3: Resettlement***		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**48**	**73**	**121**
3.1	Resettlement site no. 1	Yen Ninh	0	0	0	0	0	0	0	0	7	4	11
3.2	Resettlement site no. 2	Van Phu	0	0	0	0	0	0	0	0	5	4	9
3.3	Resettlement site no. 3	Tan Thinh	0	0	0	0	0	0	0	0	7	2	9
3.4	Resettlement site no. 4	Yen Ninh	0	0	0	0	0	0	0	0	6	5	11
3.5	Resettlement site no. 5	Yen Ninh	0	0	0	0	0	0	0	0	3	5	8
4	**Waste disposal site**		0	0	0	0	0	0	0	0	20	53	73
	Total		**297**	**103**	**400**	**115**	**46**	**69**	**67**	**136**	**240**	**752**	**992**

(*Source: Resettlement Plan Report of Yen Bai City Sub-project, 2017)*

641,694 m2 of land will be acquired under the project, including 494,615 m2 of agricultural land, 33,079 m2 of homestead land, 1,374 m2 of land under agencies' management, 38,366 m2 of unused land, 70,529 m^2 of land under PC's management. As discussed above, land acquisition impacts as considered as from low to medium. Most of agricultural land and land under commune/ward PC's management is unproductive and has lied fallow for a long time. Land areas affected by the construction of 13 work items under the sub-project are presented in the table below:

Table 24: Land areas affected by land acquisition for the Yen Bai City sub-project

No	Items	Ward/commune	Affected land area (m2)					Total affected land area (m2)
			Agricultural land	Non-agricultural land		Unused land	PC's land	
				Homestead land	Agencies' land			
1	***Sub-component 1: Flood control and urban safety***							
1.1	Rehabilitation of NC lakes	Nam Cuong	3,045.4	270.1	0.0	0.0	5,085.5	8,401.0
1.2	Cau Dai stream embankment	Yen Ninh	45,107.1	3,848.6	922.8	5,411.3	2,968.5	58,258.3
		Minh Tan	10,836.9	2,970.4	95.4	0.0	5,956.6	19,859.3
		Dong Tam	26,350.3	757.7	0.0	6,414.6	1,353.8	34,876.3
1.3	Hao Gia stream embankment	Dong Tam	12,359.1	6,730.5	556.6	1,649.3	237.0	21,532.5
2	***Sub-component 2: Development of urban transport, connectivity enhancement***							
2.1	Road from Dien Bien road to riverside road (road from Bach Lam bridge to Van Phu bridge)	Yan Ninh	11,195.9	2,518.2	0.0	0.0	4,365.4	18,079.4
		Minh Tan	0.0	240.1	0.0	0.0	0.0	240.1
2.2	Road from Bach Lam bridge to Van Phu bridge	Van Phu	69,747.5	798.4	0.0	4,010.6	16,681.9	91,238.4
		Yen Ninh	141,966.8	11,929.7	0.0	702.3	21,825.0	176,423.8

No	Items	Ward/commune	Affected land area (m2)					Total affected land area (m2)
			Agricultural land	Non-agricultural land		Unused land	PC's land	
				Homestead land	Agencies' land			
2.3	Road from Nguyen Tat Thanh intersection to Au Co intersection	Tan Thinh	152,334.1	6,072.7	0.0	0.0	3,342.2	161,749.0
3	***Sub-component 3: Resettlement***							
3.1	Resettlement site no. 1	Yen Ninh	12,058	0	0	0	3942	16,000.0
3.2	Resettlement site no. 2	Van Phu	1420	0	0	178	2054	3,652.0
3.3	Resettlement site no. 3	Tan Thịnh	2473	0	0	0	1933	4,406.0
3.4	Resettlement site no. 4	Yen Ninh	2899.1	472.5	0	0	591	3,962.5
3.5	Resettlement site no. 5	Yen Ninh	2821.8	0	0	0	193	3,014.8
	Total		**494,615**	**33,079**	**1,374**	**38,366**	**70,529**	**641,694**

(Source: Resettlement Plan Report)

Beside the affected land, a number of houses and architectural objects such as kitchen, breeding facility, wall, yard, gate, etc. are also affected. In particular, 1,946m2 of solid houses[18], 5,115m2 of semi-solid houses[19] and 3,230 m2 of temporary houses are also affected by the sub-project. Other affected structures include 1,504m2 of kitchen, 620m2 of toilet, 1,408m2 of breeding facilities, 251m2 of stone wall, 2,830m2 brick wall, 913m2 of yard, 185 gates, 22 water tanks and 59 wells.

In addition, 13,011 fruit trees, 12,171 wood trees, 6,160 other trees and 109,181m2 of crops are also affected. The clearance of or damage to the fruit trees, wood trees, crops, etc., will insignificantly affect the HHs' incomes because these crops bring them some extra money only. Impact level is considered as low and controllable. However, the inventory and survey of losses as well as compensation, support and resettlement plan will be conducted in such as way as to minimise these effects and maximise benefits to the HHs.

[18] Solid house: house with foundation built of concrete and brick and roof solidly built

[19] Semi-solid house: built without solid roof, roof is built of tiles or similar materials, or grade IV house

4.2.3 Impacts in the construction phase

4.2.3.1. Generic impacts

1. Impacts on the air environment

1a. Dust and gas

The emission of dust and gas during the construction of the works may reduce quality of the ambient air. Sources of dust and gas emission during the construction of the works include: (i) dredging, excavating unsuitable materials, demolishing trees and structures, clearing the site, excavating, filling, ground levelling; (ii) transporting, gathering and storing materials, transporting and disposing waste, (iii) dust from pavement, and (iv) dust and gas from construction equipment and machinery. Dust emission will affect soil and air environments, workers and people living in the sub-project area at medium and high level during the short construction period. Quantity of waste transportation is calculated by quantity of excavation of unsuitable materials, demolition of old structures and quantity of excavation subtracts re-use quantity.

Details are shown in the following table of quantities:

Table 25: Quantities of weather layer and waste soil and stone arising from the construction of the works

No	Quantity of excavation of unsuitable materials and demolishment (tons)	Quantity of excavation (tons)	Quantity of filling (tons)	Quantity of soil disposal (tons)	Quantity of re-use (tons)	Quantity of supplementation (tons)	Quantity of construction materials (tons)	Total quantity of transportation
	Embankment							
1	230360	124407	30639	93768	30639	0	199734	523862
2	5676	17661	10597	7064	10597	0	63162	75902
3	7726	31912	30420	1492	30420	0	60136	69354
4	1276	85913	67247	52374	33539	33708	241728	329086
5	27929	116531	280233	68086	48445	97134	3757443	3950592
	Roads							
6	7535	312386	45757	390216	31957	13800	429701	841252
7	14425	263870	315202	115706	148164	167038	3190153	3487322
8	12583	369418	441283	115706	148164	293119	3467186	3888594
	Resettlement sites							
9	2153	659461	46174	613287	46174	0	309156	924596
10	957	107236	71	107165	71	0	99572	207694
11	895	57662	0	57662	0	0	43276	101833
12	524	23839	14046	9793	14046	0	23490	33807
13	631	38085	2783	35302	2783	0	34499	70432

(Source: Cost estimate in the Feasibility Study Report, 2017)

(i) Dust from dredging, excavating unsuitable meterials, demolishing, excavating, filling, ground levelling

Construction of the roads and transportation of materials will produce impacts on the air quality. Transportation of soil and stone may affect workers and people living around the construction sites because of dust, noise and vibration from pile driving. Severity of these impacts depends on the location of construction and transportation distance. The projected level of impact is from medium to high during the construction period.

Dust emission is calculated on the bases of pollution coefficient P (Kg/ton) and quantities of excavation and filling. According to Environmental Assessment Sourcebook Volume II - Sectoral Guidelines Environment Department, World Bank, Washington DC, 8/1991, quantity of dust is calculated by the following formula:

$$P = k \times 0{,}0016 \times \frac{(U/2{,}2)^{1,4}}{(M/2)^{1,3}} \text{ (kg/ton).}$$

Where:

+ P: pollution coefficient (kg/ton)
+ k: granular structure (average value of 0.35)
+ U: wind speed (average value of 1.2 m/s)
+ M: average humidity of material (20 %)

Pollution coefficient calculated following the above formula is P = **0.0048** kg/ton. Dust emissions from excavation and filling of soil and stone and ground levelling are as follows:

Table 26: Quantity of dust from dredging, excavating unsuitable materials, excavating, filling and ground levelling

No	Quantity of excavation, filling and ground levelling (ton)	Quantity of dust emission (kg)	Tentative construction period (days)	Quantity of dust emission (kg/day)	Quantity of dust emission (mg/s)	Quantity of dust (mg/m^3)	QCVN 05:2013 (mg/m^3)
	Embankment						
1	155,046	741.12	720	1.029	36	0.53	
2	28,258	135.07	720	0.188	7	0.44	
3	62,332	297.95	720	0.414	14	1.08	**0.3**
4	153,159	732.1	720	1.017	35	4.51	
5	396,764	1896.53	720	2.634	91	6.68	
	Road						
6	358,143	1711.92	540	3.17	110	15.46	
7	579,072	2767.96	720	3.844	133	1.44	**0.3**
8	810,701	3875.15	720	5.382	187	3.33	
	Resettlement						
9	705,636	3372.94	300	11.243	390	70.27	
10	107,307	512.93	90	5.699	198	156.05	
11	57,662	275.62	90	3.062	106	69.5	**0.3**
12	37,884	181.09	90	2.012	70	50.77	
13	40,869	195.35	90	2.171	75	72.01	

Quantities of dust emission from dredging, excavating unsuitable materials, excavating and filling in the work items of the sub-project show great differences among the work items, specifically:

Nam Cuong lakes 1, 2, 3 embankment: Dust emission results primarily from the operation of excavator, grader, trucks, levelling machine, etc. to excavate foundation and scoop soil and stone onto the trucks. The main subjects of impact are workers directly inovolved in the works and residents around the construction site. The excavation of soft soil, weathered layer and cutting off trees are carried out in advance. As almost all the waste like trees, branches and leaves are to be re-used by local people, dust emission in this work item is inconsiderable; A large quantity of sludge from lake 1 will be given in part to local people to grow trees, used as input material for Xuan Lan Brick Factory; the rest will be transported to the waste disposal sites. Hence, waste emitted from excavation of unsuitable materials for Nam Cuong lakes 1, 2,3 in Nam Cuong ward may be minimised and cause minor impacts. However, the excavation, filling and ground levelling in the construction site of 3 Nam Cuong lakes will generate a quantity of dust ranging from 0.44 to 1.08mg/m3, from 1.5 to 3.6 times higher than QCVN 05:2013. The impact of dust resulting from excavation, filling, ground levelling for the lake embankment is insignificant, the mitigating measures will be discussed hereunder.

Hao Gia stream embankment: Topographical and geological survey in Hao Gia stream shows that formation of the cover layer includes gray clay, white spots, mixed with construction materials and grit, hard plastic, texture is not tight and black gray, yellow gray, soft plastic clay. These 2 layers are unstable, erodible and easily collapse in case of flood or long inundation. A section on the embankment from Yen Thinh market (at km 6+00) to Khe Lap bridge collapsed and has been embanked using the government's urgent repair fund, the execution will proceed with the roads and surface water drainage ditches bxh=0.45x0.8m. The stream dredging and excavation of weather layer on the stream shores are manually carried out, trees, branches and leaves will be re-used by local people, the rest is transported to the disposal site. Dust emission from excavation, filling and ground levelling in Hao Gia stream embankment site is about 4.51mg/m3, much higher than QCVN 05:2013/BTNMT (0.3mg/m^3). Because people reside along the streams, dust emission from excavation and filling will affect their life at medium and high levels during the construction phase. Mitigating measures need to be taken to minimise the impacts of dust caused by excavation of weathered layer, excavation, filling and ground levelling.

Figure 33: Alley to Hao Gia embankment and the embanked sections

Khe Dai stream embankment: Quantity of dust emission from excavation of weathered layer, excavation, filling and ground levelling for Khe Dai stream embankment is 1,896 kg during the construction period, equivalent to 6.68mg/m3, 22 times higher than QCVN 05:2013/BTNMT. Topographical survey shows that the cover layer contains primarily black gray clay, mixed with construction materials and grit, layer underneath is black gray, yellow gray, soft plastic sand. Therefore, this structure is erodible and unstable and easily collapses. The unsuitable materials will be re-used by local people, the excavated weather layer to the construction gournd amounts to 27,929 tons, some will be given to local people to elevate their houses, the rest will be delivered to disposal site, which low-lying sites are located along construction sites. Therefore, the waste soil and stone are considered to cause no major impact.

Figure 34: Residential areas along Khe Dai stream embankment

Road from Dien Bien road to riverside road (road from Bach Lam bridge to Van Phu bridge) – road no.1: dust emitted from excavation, filling and ground levelling is estimated at 3.17kg/ngày, equivalent to 15.5mg/m3, around 52 times higher than QCVN05:2013/BTNMT. The construction works goes through an earth road, with production forest on both sides under the program for handing over land and forest to people. The section near the intersection and road to the resettlement site no.1 is densely popuated with many solid houses all along the road. Dust emission mitigating measures are essential and will be discussed in the next chapter. Impact in this area is insignificant.

Figure 35: Road no. 1 – road from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge

Road no. 2 – from Bach Lam bridge to Van Phu bridge: The construction works is located on an uneven terrain consisting of mountains intertwined with lakes and ponds and sparse

population which is concentrated mainly on two sides of the road. Dust emission and construction operations will primarily affect the HHs adjacent to the constructed road. Quantity of dust emission from the construction of road no.2 is estimated at 1.44mg/m3, around 5 times higher than QCVN05:2013. Unsuitable materials excavated will be transported to disposal sites. Impacts are considered low and controllable.

Figure 36: Road no. 2 – from Bach Lam bridge to Van Phu bridge

Road no. 3 – from Nguyen Tat Thanh intersection to Au Co intersection: This work item will require a large quantity of excavatio nand filling since this is a completely new road. An earth road connecting Tan Thinh commune with the outside is available. The topography is featured by mountains and hills with population scatter sparsely along the route, thus, the excavation and filling herein are moderate. Dust emission is estimated at 3.33mg/m3 in the construction site, which is around 11 times higher than QCVN 05:2013 (0.3mg/m3). Mitigating measures will be discussed hereafter.

Figure 37: Road no. 3 – from Nguyen Tat Thanh intersection to Au Co intersection

Resettlement site no. 1: This resettlement site for road no. 1 - Road from Dien Bien road to road from Bach Lam bridge to Van Phu bridge is located in Yen Ninh ward. At the present, these low hills are being reforested under the government's program for handing over land and forest to local people. A large excavation quantity will be executed (approximately 660,000 ton), while the filling quantity is small. The upper-layer vegetation will be re-used by local people and the rest will be dumped at the disposal sites. Dust emission comes primarily from the excavation, filling and ground levelling for resettlement site no. 1. Dust emission occasioned by the excavation, filling and ground levelling here is estimated at 70.27mg/m3. Large dust emission in the construction site will directly affect the workers and residential areas at the

intersection at pile no. 34, near the road leading to Hoang Lien Son Pottery Factory. Dust controlling measures are required.

Figure 38: Resettlement site no. 1

Resettlement site no. 2: This resettlement site is located at the end of road no. 2 – from Bach Lam bridge to Van Phu bridge with sparsely scattered population. Dust emission comes primarily from the excavation, filling and ground levelling. The upper-layer vegetation will be re-used by local people fire wood, while the waste soil and stone will be given to them to elevate their houses and the rest will be dumped at the disposal sites. Dust emission is estimated at 156mg/m3, which is much higher than QCVN 05:2013/BTNMT due to the moderate excavation and filling quantity, medium construction area and short construction duration (estimated at 3 months). Therefore, dust emission is high. Degree of impact is estimated at medium and high, which will directly impact the workers and 3 HHs adjacent to the construction site. Mitigating measures need to be adopted to minimise impacts from these excavation, filling and gound levelling operations.

Figure 39: Resettlement site no. 2

Resettlement site no. 3: This resettlement site is located on road no. 3 – from Nguyen Tat Thanh road to Au Co intersection. Given the low quantities of excavation of weathered layer, excavation, filling and ground levelling and the absence of embankment, dust emission in the construction site is estimated at 69.5mg/m3, which is much higher than QCVN05:2013 (0.3mg/m3). Population is sparsely scattered along the existing road. Degree of impact is from medium to high, which is mostly on the workers directly involved in these operations. Mitigating measures are necessary.

Figure 40: Resettlement site no. 3

Resettlement sites no. 4, 5: These sites are located in the beginning of road no. 2 in groups 6, 7, and 39 - Yen Ninh ward. Population is scattered in groups. The construction of the works will affect primarily the workers directly involved and the HHs adjaccent to the construction site. Dust emission from excavation, filling and ground levelling is estimated at 50.8 – 72.0mg/m3, much higher than QCVN 05:2013/ BTNMT. Mitigating measures are necessary.

Figure 41: Resettlement site no. 4 (a), Resettlement site no. 5 (b)

As such, estimated dust emission from excavation of weathered layer, excavation, filling and ground levelling is 1.5 to hundreds of times higher than the allowed limited as per QCVN 05:2013/BTNMT, impact level is from medium to high, which is mostly caused by the execution of the resettlement sites with the extensive soil works lasting for 6-10 weeks. However, dust emitted has large size, settles quickly and lasts for a short time, thus causing no major impacts on local people, who are not concentrated but scatter sparesely in these areas. Apart from workers directly involved in the execution, some other sensitve areas will also be affected by dust emission; it is, therefore, advisable that the contractor takes appropriate measures to alleviate dust emission from the excavation, filling, ground levelling and excavation of weathered layer.

(ii) Dust from the material loading, transportation and gathering

Sources of dust emission from material loading, transportation and gathering include (i) soil and stone transportation, and (ii) construction metarial and fuel transportation. Subjects of the impacts include people living in the construction sites and on the transportation roads such as Tran Binh Trong, Yen Ninh, Thanh Cong, Ly Thuong Kiet, NR70, Nguyen Tat Thanh, Au Co, Dien Bien, 32C... and workers directly involved in these operations. Impact level is from medium to high during the execution time. Impact level may be lowered by means of appropriate mitigating measures as stated herein.

Dust emitted from loading and transportation of soil, stone and waste materials: Based on the coefficients for dust emission from construction material and waste material transportation in the similar works, specifically:

➔ Quantity = 0.01 kg of dust/ ton of waste soil, stone and construction material x quantity of waste soil, stone and construction material.

Thus, the following table presents dust emissions from transportation fna gathering of construction materials:

Table 27: Dust emission from transportation of soil and stone

Name of works	Quantity of soil and stone transportation (tons)	Transportation time (days)	Quantity of dust emission (kg)	Quantity of dust emission (mg/m3/h)	QCVN 05:2013 (mg/m^3)
Nam Cuong lake 1 embankment	324,128	720	3,241.28	0.58	
Nam Cuong lake 2 embankment	12,740	720	127.40	0.10	
Nam Cuong lake 3 embankment	9,218	720	92.18	0.08	
Hao Gia stream embankment	87,358	720	873.58	1.34	
Khe Dai stream embankment	193,149	720	1,931.49	1.70	
Road from Dien Bien Rd to the road from BL bridge to VP bridge	411,551	540	4,115.51	9.29	
Road from BL bridge to VP bridge	297,169	720	2,971.69	0.39	**0.3**
Road connecting Nguyen Tat Thanh intersection to Au Co intersection	421,408	720	4,214.08	0.90	
Resettlement site no. 1	615,440	300	6,154.40	32.05	
Resettlement site no. 2	108,122	90	1,081.22	82.24	
Resettlement site no. 3	58,557	90	585.57	36.92	
Resettlement site no. 4	10,317	90	103.17	7.23	
Resettlement site no. 5	35,933	90	359.33	33.11	

Dust emission from material transportation for execution of roads no. 2, 3 and road from Dien Bien Rd to the road from Bach Lam bridge to Van Phu bridge is lower or equal to the allowed limited as per QCVN 05:2013. High dust emission mostly comes from soil and stone transportation for execution of the gounds of resettlement sites no. 1, 2, 3 and 5. Dust emission mitigating measures may be applied to minimise dust from soil and stone transportation for execution of these work items. Therefore, impact level is evaluated as medium and may be minimised by appropriate methods. Besides, attention should be paid to sensitive areas, e.g. the existing residential areas, schoos, healthcare stations, temples, pagodas, etc. during the loading and transportation of construction materials on the site.

Dust emission from loading of construction materials: Based on the dust emission coefficients provided at Assesment of Sources of Air, Water and Land Pollution, 1993, WHO on coefficients applicable to loading of sand, stone and similar materials, loading and gathering of construction materials, respective dust emission coefficients of crushed stone, sand and cement are 0.0035 kg, 0.0011kg and 0.3600 kg of dust per ton of material.

Quantity of dust = dust emission coefficient x quantity of material to be transported

Dust emission from material gathering is estimated as shown in the following table:

Table 28: Dust emission from construction material loading and gathering

Name of work	Total quantity of dust emission (kg)	Loading time (days)	Quantity of dust emission (kg/ngày)	Quantity of dust emission (mg/m^3)	QCVN 05:2013 (mg/m^3)
Nam Cuong lake 1 embankment	6,947.75	720	9.65	1.25	**0.3**
Nam Cuong lake 2 embankment	2,118.32	720	2.94	1.73	
Nam Cuong lake 3 embankment Nam Cường 3	1,926.02	720	2.68	1.75	
Hao Gia stream embankment	3,464.14	720	4.81	5.33	
Khe Dai stream embankment	18,776.50	720	26.08	16.54	
Road from Dien Bien road – road from Bach Lam bridge to Van Phu bridge	25,073.59	540	46.43	56.62	
Road from Bach Lam bridge to Van Phu bridge	669,969.44	720	930.51	86.91	
Road from Nguyen Tat Thanh intersection and Au Co intersection	938,317.35	720	1303.22	201.43	
Resettlement site no. 1	126.28	300	0.42	0.66	
Resettlement site no. 2	15.74	90	0.17	1.16	
Resettlement site no. 3	9.35	90	0.1	0.57	
Resettlement site no. 4	3.99	90	0.04	0.25	
Resettlement site no. 5	5.98	90	0.07	0.58	

Large quantities of materials will be mobilised for the execution of the roads, Khe Dai, Hao Gia stream embankment and resettlement sites, resulting in large quantities of dust emission from material loading and gathering in the construction sites of the sub-project's work items. Dust emission is dozens to hundreds of times higher than the allowed limits under QCVN 05:2013, reaching the highest in the construction site of the road connecting Nguyen Tat Thanh to Au Co intersection. Moderate dust emission from material loading and gathering is estimated for the remaining work items, e.g Nam Cuong lakes 1,2,3 embankment, resettlement sites, which is equal to or 2-6 times higher than QCVN. As such, dust emission level is evaluated as from medium to high, causing impacts on the workers directly involved in the above operations and people living near the material gathering site. In case of changing wind speed, this impact is evaluated as from low to medium. It is necessary to work out dust minimising methods to reduce its impacts on workers and HHs in the vicinity.

(iii) Dust from pavement of the roads resulting from construction material transportation

The transportation of construction materials will give rise to a large amount of dust from the pavement. Its impact on the surrounding environment and quality of the suspended dust depend on the climatic conditions. Amount of dust in the air may rise on hot days. Subjects of impact include people residing in the construction areas and along the transportation roads, e.g NR70 (distance to the nearest residential area is 10-50m), Nguyen Tat Thanh (20-50m), Au Co (20-100m), Tuan Quan bridge (15-100m), Bao Luong (50-100m), Yen Ninh (10-30m), Cao Thang (20-50m), Ly Thuong Kiet (20-100m), Dien Bien (10-30m), Tran Binh Trong (10-50m), etc., and workers directly involved. Impact level is estimated as from low to medium and short-term, which could be minimised by appropriate measures, specifically:

During the construction of the works, total quantity of construction materials to be transported is estimated at 11,919,237 tons. Average load of transportation truck is estimated at 10 tons (from 5 to 12 tons depending on the sites). As such, during the construction of the works, number of loaded truck trips to the sub-project areas is 94,679, in which, trips of unloaded trucks are estimated as ½ of loaded trucks.

Dust emission from the transportation of materials is determined following the formula below (According to Air Chief, US Environment Department, 1995):

$$L = 1{,}7k\left[\frac{s}{12}\right]\times\left[\frac{S}{48}\right]\times\left[\frac{\mathrm{W}}{2{,}7}\right]^{0,7}\times\left[\frac{w}{4}\right]^{0,5}\times[(365-p)/365]$$

Where:

L: Quantity of dust (kg/turn of truck.km)

k: Granular size factor (= 0.8 for dust larger than 30 micron)

s: Pavement factor (8.9 for earth road adjacent to urban area)

S: Average speed of truck (40 km/h)

W: Weight of loaded truck (10 tons)

w: number of wheels (10 wheels)

p: average number of rainy days, p = 180 days.

Dust emission from 1 truck is:

L=0. 4211 kg of dust/km.turn of truck.

Dust is emitted from the transportation of materials within a range of 10km. Quantity of dust during the construction period is calculated as follows: L x number of km of transportation x turns of trucks to the work site.

Average dust concentration emitted into the air is calculated by the following formula:

C (mg/m3) = M (kg/day)x10^6/(24xV) (m3)

Areas subject to impacts are the construction sites and their vicinity, transportation distance is 10km, the width is 10m. Volume of impact on the sub-project V = S x H (S is construction area

of each work item and height H = 10m, as meteorological parameters are measured at a height of 10m). Kết quả cho thấy:

Table 29: Dust from pavement during transportation of meterials, soil and stone

Name of work	Quantity of transportation (tons)	Number of trucks (turns/day)	Quantity of dust emission (kg/km/day)	Quantity of dust emission (mg/m3)	QCVN 05:2013
Nam Cuong lake 1 embankment	523,862	109	45.98	0.99	0.3
Nam Cuong lake 2 embankment	75,902	16	6.63	0.65	
Nam Cuong lake 3 embankment Nam Cường 3	69,354	14	6.06	0.66	
Hao Gia stream embankment	329,086	69	28.87	5.33	
Khe Dai stream embankment	3,950,592	823	346.59	36.63	
Road from Dien Bien road – riverside road	841,252	234	98.41	20.00	
Road from Tuan Quan bridge to Van Phu bridge	3,487,322	727	305.97	4.76	
Road from Nguyen Tat Thanh intersection and Au Co intersection	3,888,594	810	341.15	8.79	
Resettlement site no. 1	924,596	462	194.67	50.70	
Resettlement site no. 2	207,694	346	145.78	166.33	
Resettlement site no. 3	101,833	170	71.44	67.56	
Resettlement site no. 4	33,807	56	23.75	24.97	
Resettlement site no. 5	70,432	117	49.46	68.35	

Quantity of dust emission is high, from dozens to hundreds of times higher than the allowed limits, impacting mainly workers carrying out the works in the sub-project area and HHs adjacent to the sub-project area. Lowest quantity of dust emission is evaluated for Nam Cuong embankment site, medium quantity for construction sites of roads no.1, 2, 3 and Khe Dai embankment site and high quantity for construction of resettlement sites. Construction sites of resettlement sites have no or small population, no major traffic activities and the construction operations are short-term. Moreover, construction dust has large size (> 30 micromet), settles quickly and spreads within a small range, and because the work site is near the river, dust increases only in windy and dry conditions and in June, July and August. Therefore, special attention should be paid to mitigation of dust pollution from material transportation, especially in dry season, low humidity and sunny days.

Dust from the pavement resulting from material transportation considerablly contributes to quantity of dust on the work site and the related areas, which affects agricultural activities in the surrounding areas, businesses along the transportation roads, travellers' sight and people on the construction sites. These impacts are evaluated as controllable. Pavement dust control measures are needed to be taken by construction contractors.

(iv) Dust and gas from vehicles, equipment and machinery on the site

Toxic gases are given off by (a) the operation of equipment and machinery on the site, and (b) vehicles used for the execution of proposed items. These gases significant ly impact the makeup

of subtances in the air. Emitted gas is made up of dust, toxic gases of NO2, SO2, CO and total Hydrocacbon (THC), which directly impact the environment and workers directly engaged in the execution as well as people in the project area. Impact frequency is continuous during the operation of vehicles, equipment and machinery for workers and interruptive for surrounding residential areas. Impact level is evaluated as from low to medium during the execution of the sub-project's work items.

Dust and gas emitted from vehicles

For an overview of the impacts of these emissions, their quantities are caculated following the rapid environmental evaluation method by World Health Organisation - WHO. Oil used in construction of the works is Diesel (DO). Based on the DO quantity used, quantities of dust and toxic gases at their respective pollution coefficients. Based on the distance of transportation, each km travelled by a 10 ton truck takes about 0.3 litre of DO (d_{DO}= 0.89 kg/l=0.89 ton/m^3), DO quantity used for the relevant work item can be estimated. Table of discharge quantity estimate with respect of each specific work item will then indicate discharge quantity of the toxic gases. The unwelcome contributions of toxic substances to the base environment is a warning for contractors taking no mitigating actions or taking inappropriate ones.

Quantity of toxic gas emission during the execution of the sub-project's work items:

Table 30: Materials and fuel for operation of construction equipment, machinery and vehicles

No	Items	Fuel for equipment and machinery (tons/day)	No. of trips to and from the site (trips/ngày)	Fuel for transportation (tons/day)	DO quantity used (tons/day)
1	Nam Cuong lake 1 embankment	0.04	109	0.29	0.33
2	Nam Cuong lake 2 embankment	0.01	16	0.04	0.05
3	Nam Cuong lake 3 embankment	0.01	14	0.04	0.05
4	Hao Gia stream embankment	0.03	69	0.18	0.22
5	Khe Dai stream embankment	0.63	823	2.20	2.83
6	Road from Dien Bien road to road connecting Bach Lam bridge to Van Phu bridge	0.53	234	0.62	1.15
7	Road connecting Bach Lam bridge to Van Phu bridge	0.99	727	1.94	2.93
8	Road connecting Nguyen Tat Thanh intersection to Au Co intersection	0.15	810	2.16	2.31
9	Resettlement site no. 1	0.80	462	1.23	2.03
10	Resettlement site no. 2	0.98	346	0.92	1.91
11	Resettlement site no. 3	0.43	170	0.45	0.88
12	Resettlement site no. 4	0.23	56	0.15	0.38
13	Resettlement site no. 5	0.34	117	0.31	0.65

According to Evaluation of air, water and soil pollution sources – volume 1 by WHO's rapid evaluation method, 1993, vehicles from 0.3 to 16 tons using diesel will emit dust and toxic gases such as CO, SO_2, NO_2, and VOC as follows:

Dust: 0.90 g/km;

SOx: 4.29*S g/km;

NOx: 11.80 g/km;

CO: 6.00 g/km;

THC: 2.60 g/km.

10 ton trucks will be used for the sub-project, avaerage distance of each trip is 10km. Quantities of dust and gases from transportation of materials and operation of equipment and machinery are as follows:

Table 31: Quantities of toxic gas emission from construction of the works

No	Items	Pollution quantity (mg/m3)				
		Dust	SO2	NOx	CO	THC
1	Nam Cuong lake 1 embankment	0.0057	0.0001	0.0744	0.0378	0.0164
2	Nam Cuong lake 2 embankment	0.0037	0.0000	0.0485	0.0247	0.0107
3	Nam Cuong lake 3 embankment	0.0038	0.0000	0.0494	0.0251	0.0109
4	Hao Gia stream embankment	0.0304	0.0004	0.3988	0.2028	0.0879
5	Khe Dai stream embankment	0.2090	0.0025	**2.7404**	1.3934	0.6038
6	Road from Dien Bien road to road connecting Bach Lam bridge to Van Phu bridge	0.1141	0.0014	**1.4965**	0.7610	0.3297
7	Road connecting Bach Lam bridge to Van Phu bridge	0.0272	0.0003	**0.3564**	0.1812	0.0785
8	Road connecting Nguyen Tat Thanh intersection to Au Co intersection	0.0501	0.0006	**0.6575**	0.3343	0.1449
9	Resettlement site no. 1	0.2893	0.0034	**3.7930**	1.9287	0.8358
10	Resettlement site no. 2	**0.9492**	0.0113	**12.4445**	6.3277	2.7420
11	Resettlement site no. 3	**0.3855**	0.0046	**5.0547**	2.5702	1.1137
12	Resettlement site no. 4	0.1425	0.0017	**1.8683**	0.9500	0.4117
13	Resettlement site no. 5	**0.3900**	0.0046	**5.1138**	2.6003	1.1268
	QCVN 05:2013/BTNMT	**0.3**	**0.35**	**0.2**	**30**	
	QCVN 06:2009/BTNMT					**5**

It can be concluded from the dust and gas emissions from operation of operation of machinery and equipment that gas pollution is higher than the allowed limits in the construction sites of thte sub-project's work items. The operation of machinery and equipment does not cause SO2, CO and THC pollution, meanwhile, Nox, THC and dust pollution in most of the sites is from several to dozens of times higher than the allowed limits under QCVN 05:2013 and QCVN 06:2009/BTNMT.

In Khe Dai stream embankment site: Quantity of NOx is 14 times higher than QCVN05:2013/ BTNMT. However, the area affected by the execution of this work item is located behind houses at piles from L89 to L92, and HHs along Yen Binh, Nguyen Tat Thanh, Km5, Dien Bien, Yen Bai bridge, NR37, Cao Lanh, Tran Binh Trong roads. Other quantities of dust and gas are within the allowed limits.

Figure 42: Residential area on Khe Dai stream embankment

Road from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge and resettlement site no.1: NOx quantity is 7 times higher than allowed limits. In this area, due to scattered population and low traffic density, diffusion of toxic gases to local people (at piles TD1, TD3, TD6) are inconsiderable and short-lived. Residential areas along the roads of Yen Binh, Van Tien, Bao Luong, Cao Lanh, Ho Xuan Huong, NR37 are also subject to impacts.

Figure 43: Residential area on road no. 1, resettlement site no. 1

Road no.2 – road from Bach Lam bridge to Van Phu bridge: Residential areas along this road are subject to impacts from toxic gases. Specifically, residential areas at Km 0-Km 0+400 at TD1, TC2; Km 3-4 tại cọc 29, 30, 33, 34; Km 4 – Km 5 at piles 2A, TC4, TC5, piles 24-28, piles 35-39 and on the roads for transportation of materials (Yen Binh, Van Tien, Bao Luong, Cao Lanh, Ho Xuan Huong, NR37).

Figure 44: Residential area on road no. 2 and resettlement sites no. 2,4,5

Road no. 3 – from Nguyen Tat Thanh intersection to Au Co intersection, resettlement site no. 3: Subjects of impact are HHs located along the roads of Nguyen Tat Thanh, Au Co, Tuan Quan, NR70, NR37, and residential area along the road at piles 85, 66A, 49, ND9, A42, A43, 80, 88, 76.

Figure 45: Residential area on road no. 2 and resettlement sites no. 2,4,5

Resettlement sites: NOx quantity is 9.5 – 62 times higher than the allowed limits, dust quantity in resettlement site no.2 and no. 3 is 1.3 – 3.2 times higher than the allowed limits. In the resettlement sites, due to sparse population, only HHs adjacent to the roads for transportation of construction materials and waste meterials, i.e. NR70, NR37, Dien Bien, Km5, Bao Luong, Cao Lanh, Tuan Quan, Yen Bai, are subject to impacts.

In general, impacts of dust and toxic gases from transportation of materials and waste soil and stone are of low and medium levels and short-term. The densely populated wards in the city centre of Yen Ninh, Minh Tan, Dong Tam are subject to medium impacts from transportation of materials and waste soil and stone; whereas, residential areas along the Van Phu, Tuan Quan, Bao Luong, Yen Bai, Van Tien, NR37, NR70 and Van Hoi are subject to low impact level due to sparse population and large diffusion range. Appropriate construction methods may reduce these impacts.

Dust and gas emission from construction machinery and equipment on the site

Construction machinery and equipment involved in the execution of work items also produce a considerable amount of gas. During the levelling, excavation and filling, gases are emitted principally from the engines of: grader, excavator, rammer, etc. Gases including mostly CO, NO2, SO2, etc. are produced from the use of DO.

These gases directly affect workers operating construction equipment and machinery and HHs nearby. Impact level is from low to medium. Impact frequency is continuous during the construction time. Appropriate measures may be applied to reduce impacts of dust and toxic gases from the operation of construction machinery and equipment.

According to Rapid inventory techniques in environmental pollution assesssment (WHO-Geneva -1993), emission factor EFi of construction equipment and vehicles is presented in the table below:

Table 32: Emission factors of some toxic substances (kg/u)

No	Unit	Emision factor TSP (kg/u)	Emision factor PM10 (kg/u)	Emision factor SO2 (kg/u)	Emision factor NOx (kg/u)	Emision factor CO (kg/u)	Emision factor VOCs (kg/u)
1	2.5T car	3,5	1,37	20S	13	20	9,5
2	5m3 watering truck	3,5	1,37	20S	13	20	9,5

No	Unit	Emision factor TSP (kg/u)	Emision factor PM10 (kg/u)	Emision factor SO2 (kg/u)	Emision factor NOx (kg/u)	Emision factor CO (kg/u)	Emision factor VOCs (kg/u)
3	Dump truck 5T	4,3	1,37	20S	70	14	4,0
4	Dump truck 7T	4,3	1,37	20S	70	14	4,0
5	10T truck	4,3	1,37	20S	70	14	4,0
6	108 CV grader	4,3	1,37	20S	65	10	8
7	108CV bulldozer	4,3	1,37	20S	65	10	8
8	180CV bulldozer	4,3	1,37	20S	65	10	8
9	1.6m3 excavator	4,3	1,37	20S	65	10	8
10	0.8m3 clampshell	4,3	1,37	20S	70	14	4,0
11	75KVA electric generator	3,5	1,37	20S	13	20	9,5
12	15CV pump	3,5	1,37	20S	13	20	9,5
13	Pile driving machine	3,5	1,37	20S	13	20	9,5
14	Concrete mixing machine	4,3	1,37	20S	65	10	8
15	240-360m3/h air compressor	3,5	1,37	20S	13	20	9,5
	Average	**4,11**	**1,37**	**20S**	**53,94**	**13,29**	**7,41**

(Source: WHO-Geneva -1993)

Where:

U**:** unit is 1 ton of fuel consumed by the machine

S: sulphur content (% of weight) of fuel.

Emission quantities of dust and toxic gases from the operation of machinery and equipment are shown in the following table:

Table 33: Emission quantities of dust and some toxic gases from construction equipment (mg/m^3)

No	Items	Fuel for machinery and equipment (ton/day)	Dust	PM10	SO_2	NO_x	CO	VOC
1	Nam Cuong lake 1 embankment	0.04	0.0381	0.0127	0.0005	0.4996	0.1231	0.0686
2	Nam Cuong lake 2 embankment	0.01	0.0115	0.0038	0.0001	0.1504	0.0370	0.0207
3	Nam Cuong lake 3 embankment	0.01	0.0125	0.0042	0.0002	0.1644	0.0405	0.0226
4	Hao Gia stream embankment	0.03	0.0291	0.0097	0.0004	0.3819	0.0941	0.0525
5	Khe Dai stream embankment	0.63	0.5585	0.1062	0.0068	7.3294	1.8059	1.0069
6	Road from Dien Bien road to road connecting Bach Lam bridge to Van Phu bridge	0.53	0.4697	0.1466	0.0057	6.1647	1.5189	0.8469
7	Road connecting Bach Lam bridge to Van Phu bridge	0.99	0.8787	0.1129	0.0107	11.5324	2.8414	1.5843
8	Road connecting Nguyen Tat Thanh intersection to Au Co intersection	0.15	0.1311	0.0437	0.0016	1.7209	0.4240	0.2364
9	Resettlement site no. 1	0.80	0.7089	0.1363	0.0086	9.3038	2.2923	1.2781
10	Resettlement site no. 2	0.98	0.8744	0.1415	0.0106	11.4757	2.8274	1.5765
11	Resettlement site no. 3	0.43	0.3097	0.1266	0.0046	4.9833	1.2278	0.6846
12	Resettlement site no. 4	0.23	0.2061	0.0687	0.0025	2.7042	0.6663	0.3715
13	Resettlement site no. 5	0.34	0.3027	0.1009	0.0037	3.9731	0.9789	0.5458
	QCVN 05: 2013		**0.3**	**0.15**	**0.35**	**0.2**	**30**	
	QCVN 06: 2009							**5**

The above figures show that the operation of construction machinery and equipment on the site will cause dust pollution at the highest level on the construction site of road no.2 – road connecting Bach Lam bridge and Van Phu bridge, and lowest level on the construction site of 3 Nam Cuong lakes. Quantity of dust emission in some areas is 1.26 to 2.93 times higher than the standards, in particular:

- Khe Dai stream (residential areas from pile L89 to L92, distance to the neareast house is 10 – 200m),
- Road no. 1 and resettlement site no.1 (residential areas at piles TD1, TD3, TD6 with the shortest distance to the site of 0 - 20m),
- Road no.2 and resettlement site no.2 (residential areas at Km 0 - Km 0+400, Km 3-4, Km 4 – Km 5 with the shortest distance to the site of 10-100m).

Other gases such as PM10, SO_2, NOx, CO, VOC are much lower than the allowed limits under QCVN 05:2013/BTNMT and QCVN 06:2009/BTNMT.

Dust and toxic gases from construction machinery and equipment directly affect workers on the site and surrounding residential areas. However, dust and gas will diffuse rapidly in the air and the degree of pollution will reduce accordingly. Then, impact level by emission of dust and gas is considered as from low to medium. The impacts are short-lived and interruptive due to discontinuous operation of machinery and equipment.

Furthermore, the impacts involve lung, eye and cancer risks. Dust affects respiratory system and cornea, whereas, CO is harmful to the respiratory system as it depletes the oxygen needed for blood circulation. The evaluation of composition and discharge quantity of these gases facilitates the early detection, calculation of discharge quantities and control planning. Adoption of reasonable measures will help alleviate these impacts.

Reasonable mitigating measures if applied are expected to minimise their impacts on the environment and health of workers on the site and surrounding HHs.

1b. Impacts of noise

Noise is emitted from the operation of construction equipment, vehicles, pile driving in embankment sites, pile compaction caused by bulldozer, excavator, pile driving machine, rammer, etc. and afects the surounding environment. Subjects of impact include workers performing the execution on the site and HHs nearby. Noise frequency is during the construction period. Noise level is evaluated as from medium to high. If appropriate construction methods are applied, noise level may be reduced correspondingly.

Resonance of noises on the site raises noise level in the areas where a large amount of machinery and equipment and at certain times. Noise resonance may be created in the same area at the same time, thus actual noise level will be higher if machinery and equipment differ in noise level. Besides, existing noise level in the construction sites of Hao Gia, Khe Dai streams and roads are 1.02 – 1.08 times higher than the allowed level.

Noise levels of construction machinery and equipment are shown in the table below:

Table 34[20]: Noise level of construction equipment and resonant noise level

No	Machines	Noise level 15m from source (dAB)	Resonant noise level 15m from source (dBA)
1.	7-10 ton truck	70-96	73-99
2.	110CV, 140CV bulldozer	77-95	80-98
3.	Vibro rammer, vibratory plate compactor, needle vibrator	72-88	75-91
4.	108CV automotive grader	69-86	72-89
5.	Borer	74-88	77-91
6.	Concrete mixing machine	75-86	78-89
7.	Excavator	70-80	73-83
8.	Welding machine	72-82	75-85,5
10.	Vibro-rammer	70-80	73-99
11.	Electric generator	72-82	80-98

[20] Source: *FHA (USA)*

No	Machines	Noise level 15m from source (dAB)	Resonant noise level 15m from source (dBA)
12.	Pile driving machine	72-85	75-91
	QCVN 26:2010/BTNMT (6h – 21h)	**70**	**70**

The following formula is used to calculate noise impact radius:

$$M_1\text{-}M_2=20 \times \log (R2/R1)^{21}$$

Where:

M_1: Noise level at location 1

M2: Noise level at location 2

R1: Distance from source to location with noise level 1

R2: Distance from source to location with noise level 2

Based on the above formula, noise levels of equipment and machinery are calculated by distance from source as shown in the table below:

Table 35: Noise levels of equipment and machinery by distance from source

No	Machine	Noise level from source (dAB)							
		15m	30m	60m	120m	240m	450m	600m	900m
1.	Truck	73-99	80	74	68	62	56,5	54	50,5
2.	Bulldozer	80-98	83	77	71	65	59,5	57	53,5
3.	Air temper	75-91	77	71	65	59	53,5	51	47,5
4.	Air compactor	72-89	74,5	68,5	62,5	56,5	51	48,5	45
5.	Mobile crane	78-98	82	76	70	64	58,5	56	52,5
6.	Saw machine	83-85	78	72	66	60	54,5	52	48,5
7.	Borer	79-102	84,5	78,5	72,5	66,5	61	58,5	55
8.	Concrete mixing machine	77-91	78	72	66	60	54,5	52	48,5
9.	excavator	78-89	77,5	71,5	65,5	59,5	54	51,5	48
10.	Vibro rammer	73-83	72	66	60	54	48,5	46	42,5
11.	Electric generator	75-85,5	74	68	62	56	50,5	48,5	45
12.	Pile driving machine	75-88	75,5	69,5	63,5	57,5	52	49,5	46

The noise levels in the above table show that noises emitted from construction machinery and equipment are lower than 70dAB out of the 240m range and decrease in proportion with distance from construction site to the affected area.

[21] U.S department of transportation, 1972

The most considerable among the above noise sources is noise from trucks carrying materials passing residential areas. Subjects of these noises are HHs adjacent to the construction site and transportation roads and workers directly performing the execution.

According to Canter - Environmental Impact Assessment, Mc Graw Hill, (1996), standard distance from noises cuased by trucks is at least 30m and up to 121 m. Hence, noise level along the roads for transportation of construction materials and waste soil and stone will be higher than the standards under QCVN 26:2010/BTNMT. HHs located along these roads will be subject to noises caused by trucks serving the sub-project components. Most of other sources of noise are site-specific and affect only workers on the construction site and HHs adjacent to embankment sites or some HHs in the residential areas along the roads within the distance from 10 to 100m to the nearest residential area. The operation of machinery and machinery will directly affect the residential area on Khe Dai stream embankment route (30-100m), where some HHs are adjacent to two shores of the stream, and some HHs in the interchanges with road no. 1 – from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge (0 – 20m), road no. 2 – road connecting Bach Lam bridge to Van Phu bridge (10 – 100m). Noise impact from the machinery and equipment only comes up at certain times during the execution process and will cease when the execution is completed. The machinery and equipment will not operate continuously during the construction of the works but only in phases/shifts as per progress and quantity of work items; the equipment will be periodically checked, therefore, its impacts are evaluated as low and medium. But alleviating measures should be considered and applied to limit these impacts on workers on the site and people in the sub-project areas.

1c. Impacts of vibration

Impacts of vibration are occasioned by the execution of the sub-project's work items using construction equipment. Subjects of the impacts are workers directly carrying out the execution and structures of people living near the construction site. Vibration affects local people's life, business activities and structure of houses and other architectural objects and even causes cracks and collapse of houses. Impact duration is evaluated as short during the operation of construction machinery and equipment, which may results in from medium to high level of vibration. Equipment's vibration will also cause significant impacts on the ambient environment as shown in the table below:

Table 36: Vibration of construction machinery and equipment

No	Machine	Reference vibration level from source (in vertical direction, dBA)		
		10 m	30 m	40m
1.	Truck	74	64	59
2.	Earth bulldozer	79	69	63
3.	Air temper	93	83	75
4.	Air compactor	81	71	67
5.	Borer	63	52	48
6.	Concrete mixing machin	76	66	61
7.	excavator	80	71	66
8.	Vibro rammer	82	72	65
9.	Pile driving machine	93	83	75
	QCVN 27:2010/ BTNMT (6h – 21h)	**75**		

The above table shows that the vibrant accelerant caused by construction machinery and equipment are beyond the standard limits for the range of 10m, but within the standard limits for the range of 40m upwards. As a result, vibration from construction activities mostly impacts workers on the site. In particular:

In the embankment site of Nam Cuong lakes 1, 2, 3, some HHs are only 5-10m away from the construction site. But the construction of the works is carried out behind their houses, adjacent to their empty land, gardens or fruit trees and production forest land.

The embankment site of Hao Gia and Khe Dai streams is also adjacent to local people's houses in some sections (10-100m from the site), Kim Dong Primary School, Hoa Hong Kindergarten –Minh Tan ward in a distance of 5-10m, but this affects only the land areas behind or near these residential areas and schools without any impacts on the structures on the land within the impact range. This impact is, therefore, considered as low.

As for roads no. 1, 2, 3 and resettlement sites, houses are adjacent to construction sites at the interchanges with the existing roads on the newly built road from Dien Bien road to the road from Bach Lam bridge to Van Phu bridge (at piles TD1, TD3, TD6), the road from Bach Lam bridge to Van Phu bridge (at Km 0 – Km0+400, Km 3- Km4 and Km 4 – Km5), some residential areas are 10-100m away from the construction site. As a result, HHs may be affected by vbration from operation of machinery and equipment within a range of 10-30m, but at a low level. Given that the machinery and equipment is not operated continuously and simultaneously, the local vibration resonance is non-existent.

Impact level of vibration is evaluated as low and short-lived at some construction times. Appropriate construction methods and plans are expected to limit these impacts on local HHs and workers.

1c. Impacts of smell

Smell will emit from the dredging of Nam Cuong lake 1, Khe Dai and Hao Gia streams. When excavated and brought to the surface, the existing balance structure of sludge will be disrupted, organic matters and some other vaporisable matters will vaporise and give off bad smells. Smelly gases include VOC, H_2S, CH_4, amino acid, organix acid, other compounds... Subjects of smell are workers performing the execution on ths site and HHs near the construction sites. However, the impact occurs only during the short period of dredging and appropriate construction methods will minimise this impact. Impact level is, therefore, considered as low.

According to research results of Cambridge Environment Research Organisation on smell based on awareness magnitude:

- Smell detection: 1 Ou/m^3
- Light smell: 5 Ou/m^3
- Particular and strong smell: 10 Ou/m^3

Based on these awareness magnitudes and the construction of similar projects in Yen Bai city, smell is likely to diffuse from the dredging of sediment at 1.23 – 4.42 Ou/m^3. Smell impact coming from dredging is evaluated as low and short-lived.

2. Impacts on water environment

During the construction period of work items under component 1 of the sub-project, there are 4 major sources of impacts on water environment, namely: (i) Rain water flowing out from the construction site; (ii) Domestic wastewater of workers; (iii) wastewater from construction operations, and (iv) water leaking from dredging of lakes.

Rainwater overflowing on the construction site

Rainwater is considered as clean water without being exposed to such sources of contamination as: wastewater, waste gas, polluted soil/sludge… Main subjects of impact are catchments of rainwater from the construction site. During the construction of the works, rainwater overflowing on the site will sweep away soil, sand, workers' domesti waste, debris, etc. and become contaminants to surface water, soil and underground water. Impact duration is short during the construction period. Total rainwater quantity in the sub-project area during the construction period is estimated following the formula below:

$$\mathbf{Q = \varphi \times q \times S}$$

Where:

S: Total rainwater drainage area (m^2).

φ: flow factor of covering surface (road covering surface is usually asphalt and concrete pavement (φ =0.6).

q: Rain intensity (l/s.ha), q: rain intensity = 166.7 x i, with the highest water level in the month with most rains of July 2016 being 404.7mm.

Number of rainy days in July was 25 days and 3 hours/day, thus, i = 0.067 mm/minute → **q = 15.003 (l/s.ha).**

According to statistics of World Health Organisation (WHO), quantity factor of contaminants in overflowing rainwater typically ranges from 0.5 to 1.5 mgN/l; 0.004 – 0.03 mg P/l; 10 – 20 mg COD/l and 10 – 20 mg TSS/l. Then, total rainwater quantities coming out of the sub-project's construction sites are:

Table 37: Rainwater quantities on construction sites

Name of works	Worksite area (m2)	Rainwater quantity (l/s)	Pollution quawntity (tons/year)			
			T-N	T-P	COD	TSS
Nam Cuong lake 1 embankment	192600	150.3	6.92	105.21	103.89	103.89
Nam Cuong lake 2 embankment	42600	33.2	1.53	23.24	22.95	22.95
Nam Cuong lake 3 embankment	38260	29.8	1.37	20.86	20.60	20.60
Hao Gia stream embankment	22563	17.6	0.81	12.32	12.17	12.17
Khe Dai stream embankment	39427.5	30.8	1.42	21.56	21.29	21.29
Road from Dien Bien road to road connecting Bach Lam bridge to Van Phu bridge	20500	16	0.74	11.20	11.06	11.06
Road connecting Bach Lam bridge to Van Phu bridge	267661	69.6	3.20	48.72	48.11	48.11
Road connecting Nguyen Tat Thanh intersection to Au Co intersection	161749	42.1	1.94	29.47	29.10	29.10
Resettlement site no. 1	16000	8.3	0.38	5.81	5.74	5.74
Resettlement site no. 2	3652	0.9	0.04	0.63	0.62	0.62

Name of works	Worksite area (m2)	Rainwater quantity (l/s)	Pollution quawntity (tons/year)			
			T-N	T-P	COD	TSS
Resettlement site no. 3	4406	2.3	0.11	1.61	1.59	1.59
Resettlement site no. 4	3963	2.1	0.10	1.47	1.45	1.45
Resettlement site no. 5	3015	0.8	0.04	0.56	0.55	0.55

The pumping of surface water from the execution site of foundation and the daily execution of culverts and after extended rains will contribute to surface water environment pollution due to high SS content. This amount of water will negatively affect the local drainage system, impairing the quality of surface water and aqua and aquatic eco-sytem in the relevant catchments, particularly in Khe Dai stream, Hao Gia stream, Nam Cuong lake, Tuan Quan stream, small stream in Tan Thinh commune and surface water in the sub-project area. However, the impacts are low and short-lived and apprppriate measures may be taken to increase the TSS content, decrease the muddiness... in the receptors.

Worker's domestic wastewater

Number of workers carrying out the construction of the works on the worksites ranges from 15 to 188 depending on each specific worksite. Daily domestic water quantity follows the water quantity limits applicable to workers on the worksites in compliance with TC 20TCN 4474 – 87[22] and TC 20TCN33-85[23], which is 70 litres/person/day. General wastewater quantity for the construction process is:

Quantity of workers' wastewater: **V (m^3) = a*b*c/1000;**

Where:

a – Daily domestic water quantity (70 l/person/day)

b – Number of workers on worksite (person)

c – Time of workers' presence on worksite (day)

Pursuant to TCXD 33 :2006 – Water supply standards and design, generated wastewater is equal to 80% of the supplied water. Worksites and respective wastewater quantities of workers are presented in the following table:

Table 38: Quantities of worker's domestic wastewater during the construction period

No	Items	No. of workers (persons)	Construction period (months)	Qty of domestic wastewater (m3/day)
1	Nam Cuong lake 1 embankment	50	24	2.8
2	Nam Cuong lake 2 embankment	25	24	1.4
3	Nam Cuong lake 3 embankment	25	24	1.4
4	Hao Gia stream embankment	56	24	3.1

[22] Water limit for meal preparation: 25 litres/day

[23] Water limit for washing and bath: 45 litres /day

5	Khe Dai stream embankment	134	24	7.5
6	Road from Dien Bien road to road connecting Bach Lam bridge to Van Phu bridge	72	18	4.0
7	Road connecting Bach Lam bridge to Van Phu bridge	188	24	10.6
8	Road connecting Nguyen Tat Thanh intersection to Au Co intersection	125	24	7.0
9	Resettlement site no. 1	70	10	3.9
10	Resettlement site no. 2	65	3	3.6
11	Resettlement site no. 3	15	3	0.8
12	Resettlement site no. 4	18	3	1.0
13	Resettlement site no. 5	23	3	1.3

Domestic wastewater of workers involved in the construction of the works is concentrated principally in temporary camps and worksites chủ yếu tập trung ở lán trại tạm và khu vực công trường. Domestic wastewater is primarily composed of suspended solid (SS), organic matters (COD, BOD), nutritions (N, P…), micro organisms (virus, bacteria, fungi, etc). Subjects of impact include workers carrying out the construction, local people and receptors around the construction sites. Because workers reside on the worksite, time of impact is the same with the construction duration, and is evaluated as short during the construction period.

Quantities of contaminants in worker's domestic wastewater are shown in the table below:

Table 39: Quantities of contaminants in worker's domestic wastewater

Pollutant	Pollution factor[24] (g/person/day)		Quantity (kg/day)		Pollution factor (mg/l)		QCVN 14:2008 Column B
					Before treatment		
BOD_5	45	54	2.25	2.7	1000	1200	50
COD	72	102	3.6	5.1	1600	2266.7	-
TSS	70	145	3.5	7.25	1555.6	3222.3	100
Oil	10	30	0.5	1.5	222.3	666.7	20
T-N	6	12	0.3	0.6	133.4	266.7	50
Amoniac (N-NH4)	2.4	4.8	0.12	0.24	53.4	106.7	10
T-P	0.8	4	0.04	0.2	17.8	88.9	10
Coliforms	10^6	10^9	50,000	5 x 10^7	22 x 10^6	22 x 10^9	5000 (MNP/ 100ml)

According to QCVN 14: 2008/BTNMT, column B – National technical standard for domestic wastewater, worker's untreated domestic wastewater contains higher pollutant concentrations than allowed limits, for example, BOD5 concentration is 16 times higher, SS is more than 22 times higher than column B and other pollutants. Therefore, contractor must provide countermeasures to minimise impacts of wastewater when discharged into the environment and this should be included in the bidding documents as a condition for bid selection.

Wastewater, if not collected and treated appropriately, will not only pollute the environment, but also cause surface water pollution resonance on Hao Gia stream, Khe Dai stream which are already polluted by the discharge of waste by HHs and businesses; underground water at

[24] WHO, 1993

camps/warehouses and workshops and land areas adjacent to the worksites. This is also a major source of infectious diseases such as sore eyes, skin problems, directly affecting workers carrying out the execution and people in and around the sub-project area. Appropriate countermeasures, especially with respect to the camps, warehouses and workshops, need to be taken during the construction process.

The execution of work items is not concentrated at any particular point/segment, contractor should, based on the work schedule, make detailed plan for properly collecting and treating wastewater on worksite or temporary camps in order to prevent flooding and ensuring health and environment sanitation for workers living in camps and residents in the vicinity.

Construction wastewater: In addition to the above two sources of wastewater, the execution of the sub-project also produces wastewater from washing of construction equipment and machinery and trucks entering and departing from the sub-project area. This construction wastewater is of low volume, thành phần nước thải chủ yếu là suspended dregs and oil. Quantities of construction wastewater discharged into the environment during the construction period as recorded in projects of similar scale are:

Wastewater from washing construction tools and equipment: 2 m^3/day.

Wastewater from washing vehicles and machinery: 3 m^3/day.

=> Maximum construction wastewater quantity is 5 m^3/day/ worksite.

According to research conducted by Urban and Industrial Zone Environment Engineering Center – Hanoi University of Construction, pollution concentrations in wastewater from the foregoing activities are shown in the table below:

Table 40: Concentrations of pollutants in construction wastewater

No	**Type of wastewater**	**COD** (mg/l)	**Oil** (mg/l)	**TSS** (mg/l)
1	Wastewater from washing construction tools and equipment	20 – 30	-	50 – 80
2	Wastewater from washing vehicles and machinery	50 – 80	1,0 - 2,0	150 – 200
3	Cooling the equipment	10 – 20	0,5 – 1,0	10 - 50
	QCVN 40: 2011/BTNMT	**150**		**100**

Source: Urban and Industrial Zone Environment Engineering Center – Hanoi University of Construction

In addition to the wastewater resulting from washing of construction equipment and vehicles, another source of wastewater is from the dredging of lake 1 and Hao Gia, Khe Dai streams. Sludge from the dredging will be gathered temporarily along the embankment and part of lake 1. Monitoring results of sludge and sediment in these lake and streams show no sign of heavy metal pollution. Surface water of lake 1 and Khe Dai, Hao Gia streams is clean without any sign of pollution. Thus, detailed plan should be made for dredging of lakes and streams in order to minimise its impacts on the catchments which may receive suspended solids, dust, soil, stone and mud.

Subjects of impact are catchments that receive this source of wastewater. Impact level is evaluated as low and short-lived. The contractor must work out construction methods and control measures with appropriate arrangement on the worksite so as to minimise impacts of construction wastewater on the water and soil environments in the sub-project area.

3. Solid waste

Solid waste from the construction of the works include: (i) Domestic waste at camps; (ii) Construction solid waste.

(1) Domestic solid waste (DSW) at camps

DSW is the waste generated in the worker's toilets. DSW is made up mainly of easily decomposed organic matters and hard-to-decompose inorganic matters such as nylon bags, bottles, used belongings, etc., which will affect the surface water in the sub-project area, if not collected properly, due to their decomposition process and being swept away rainwater. The defecation in unallowed places will also contribute to the increase of solid waste and environmental pollution. Impact level is evaluated as low and medium and short-lived.

According to calculations and surveys, solid waste quantity generated in a day by a person is 0.5 kg/person/day. With the number of workers constantly present on the worksite of 15-188 persons, solid waste quantity generated by the sub-project is 0.8 – 68 tons/day. Quantity of DSW, which may vary as per the work progress, will reach a total of 251 tons throughout the construction process.

Table 41: Quantities of worker's domestic waste at camp sites

No	Items	Workers (persons)	Discharge qty (kg/person/day)	Construction time (days)	Waste qty (tons)
1	Nam Cuong lake 1 embankment	50	0.5	720	18
2	Nam Cuong lake 2 embankment	25	0.5	720	9
3	Nam Cuong lake 3 embankment	25	0.5	720	9
4	Hao Gia stream embankment	56	0.5	720	20
5	Khe Dai stream embankment	134	0.5	720	48
6	Road from Dien Bien road to road connecting Bach Lam bridge to Van Phu bridge	72	0.5	540	19
7	Road connecting Bach Lam bridge to Van Phu bridge	188	0.5	720	68
8	Road connecting Nguyen Tat Thanh intersection to Au Co intersection	125	0.5	720	45
9	Resettlement site no. 1	70	0.5	300	11
10	Resettlement site no. 2	65	0.5	90	3
11	Resettlement site no. 3	15	0.5	90	0.7
12	Resettlement site no. 4	18	0.5	90	0.8

No	Items	Workers (persons)	Discharge qty (kg/person/day)	Construction time (days)	Waste qty (tons)
1	Nam Cuong lake 1 embankment	50	0.50	720	18.00
2	Nam Cuong lake 2 embankment	25	0.50	720	9.00
3	Nam Cuong lake 3 embankment	25	0.50	720	9.00
4	Hao Gia stream embankment	56	0.50	720	20.16
5	Khe Dai stream embankment	134	0.50	720	48.40
6	Road from Dien Bien road to road connecting Bach Lam bridge to Van Phu bridge	72	0.50	540	19.38
7	Road connecting Bach Lam bridge to Van Phu bridge	188	0.50	720	67.84
8	Road connecting Nguyen Tat Thanh intersection to Au Co intersection	125	0.50	720	45.04
9	Resettlement site no. 1	70	0.50	300	10.50
10	Resettlement site no. 2	65	0.50	90	2.93
11	Resettlement site no. 3	15	0.50	90	0.68
12	Resettlement site no. 4	18	0.50	90	0.81
13	Resettlement site no. 5	23	0.50	90	1.04
	Total				**252**

Impact of solid waste from the daily life of workers in the temporary site camps due to domestic waste, solid waste from the excess materials when constructing the work items. If solid wastes are not properly collected and treated, they may obstruct the flow during the construction of the works, resulting in flooding, flow congestion and impeding the transportation of construction materials to the site and construction activities of workers. Solid wastes containing pathogens that cause significant risks to the water, air environments and indirectly affect the lives of workers, people and animals around the construction area if they are not properly collected and treated. It is necessary to consider, evaluate and take appropriate measures to collect, transport and dispose of these wastes, and thereby to mitigate their adverse effects.

b) Construction solid waste

This waste derives from the construction of items within the construction site. Composition of construction waste is discharged materials such as soil, stone, steel residue, steel wire, lanyard, package ... about 2-3 kg / month at each work site. But reusable metal scrapings, packages, scrapers ... will be collected by scrap collectors, some of which can be utilized in household cooking or making use for breeding and production by households around the area.

These solid wastes, if not collected, will affect the travel and transportation of workers on site and the vehicles and machinery operating on the site. In addition, the indiscriminate and arbitrary disposal of these wastes can affect the people around the site, water bodies and surrounding landscapes. However, it can be seen that the impact of construction solid waste is considered to be moderate, short-term impact during construction, which can be minimized by appropriate measures.

1. Hazardous waste

Hazardous waste is sourced from the construction of items under the sub-project. Components of these hazardous wastes include (1) wipes, paint drums, oil drums, paintbrushes,

waterproofing, waste oil, (2) welding rods, (3) light bulbs... mainly arising from the operation of mechanical and construction equipment/ devices on the site.

The amount of hazardous waste generated during the construction process is estimated at 1-2 kg/day/construction site and the amount of waste oil generated in the sub-project area depends on the number of vehicles and construction machines on site.

Average amount of discharged lubricant is about 7 liters/time of lubricant supply and lubricant supply takes place every 3 or 4 months. (Research on Recycling of Lubricants into Liquid Fuels - Military Science and Technology Center - Ministry of Defense 2002).

The impact of hazardous wastes mainly affects the land and water environment in the construction area. Impacts are considered low to moderate and likely to be mitigated by appropriate measures. However, most of means of transporting materials are maintained and maintained in the garages, the construction machines at the site are repaired, maintained by an unit hired by the contractors, waste oil is collected, so the impact of hazardous liquid waste is negligible.

These wastes are considered to be on the list of hazardous wastes under the Ministry of Natural Resources and Environment's Circular No. 36/2015 / TT-BTNMT of June 30, 2015 on the management of hazardous wastes; therefore, specific measures and guidelines to reduce the impact on workers and the environment are essential.

2. Impact on the land environment

Vegetation cover is lost due to weathering, land clearance for construction, change of land use purpose: from residential land and agricultural land to transport land, or empty land for construction. The change of soil will have impacts on the surrounding environment such as loss of protection layer, the effects of high temperature in the construction area, surface erosion, erosion of soil layers and surface water pollution, landslide in nearby areaa ... In the process of construction, measures should be taken to limit the surface washing as this will affect the progress of construction, life of workers at the site camps and people around the construction site, resulting in flooding, local congestion and impact on the surface water environment as it will take with it solid waste and other contaminants. .

As such, these risks are considered minor and occur in short time of construction, which can be mitigated by appropriate measures.

3. Impact on the ecosystem

There are no environmentally sensitive areas such as national parks, nature reserves or biosphere reserves, no discovery of plant and animal species in the Red Book, which should be protected and preserved in the project area. Therefore, implementation of the project will not affect these objects.

<u>For terrestrial ecosystems</u>

The construction will cause loss of vegetation cover, weathering layer on the top soil layer, which may cause ecological terrestrial impacts in the Nam Cuong lake embankment, Hao Gia, Khe Dai streams, roads no.1,2,3 and resettlement sites. Dust will cover leaves, reducing photosynthesis. However, the actual surveying in the project area shows that terrestrial ecosystems in the sub-project area are very poor in flora and fauna. Therefore, this impact on terrestrial ecosystems is considered low.

Leakage, fire and explosion at the fuel storage area will affect the stability of the surrounding terrestrial ecosystems, especially the production forest areas surrounding embankment of Hao Gia, Khe Dai streams, roads no. 1,2,3 and resettlement sites no. 1→5. Impact levels are considered low, short term and depending on the scale of the incident. Measures to prevent accidental leaks of fuel and fire, explosion will reduce this impact on terrestrial ecosystems.

For aquatic ecosystems

The most considerable impact of the sub-project is the water environment at construction site of Nam Cuong lake embankment, stream embankment, the first section of road no. 1 adjacent to Yen Ninh Ward and Minh Tan Ward. Site clearing, leveling, backfilling the embankment will change the ecosystem and pollute the water source such as turbidity, increase the flow of waste water and impact on aquatic animals. The ecosystem in the sub-project area is poor. Surveys show that the aquatic ecosystems of streams and lakes have simple species compositions, which are mainly stream fish, freshwater fish, frogs, toads and reptiles. There are no rare or endangered plant species or protected areas in the sub-project area. Due to the impact on the aquatic ecosystem in the short term, the level of impact is considered low and negligible.

4. Impact on women and children

The concentration of large numbers of male workers for construction of embankments, roads and resettlement sites might cause social disturbances that affect local women and their families during the construction phase. This is referred to as one of the unresolved issues in previous projects, and its consequences for women after local works are completed. They gave birth to children during the construction of the works and then expected their future husbands to return and organize weddings, and reunite with their children. In addition, the incidence and spread of infectious diseases, social diseases such as HIV/ AIDS, syphilis ... though the social diseases were not prviously recorded. Impact levels are rated as low to moderate and will have a lasting impact on the mentality, growing-up environment and personality of the next generation. Early measures and actions need to be taken to stop these consequences and ensure social security and well-being for future generations. Especially in the surrounding communes of Yen Bai city such as Van Phu, Tan Thinh...

In addition, consideration should be given to the use of female and child labor during construction. Due to the availability of this idle labor, they are often paid low wages, with long working hours, ill treatment and labor abuse. The level of impact is considered low in the short term. However, measures such as commitment to non-abusive child and women labor, maximum percentage of female workers on the site of not more than 25%... are necessary measures to prevent such risk. This should also be considered by the Project Owner as a mandatory condition of the Bidding Documents.

5. Social impacts

Social impacts may address impacts on (i) security and order in the area, creating conflicts among workers at the site or with local people; or (ii) minor competition in the supply and consumption of local products, (iii) an increase in the density and speed of means of transport (motorcycles, automobiles, machinery, equipment, etc.), causing the risk of traffic jams and road accidents, deterioration of existing roads, especially inter-village and inter-commune roads of Tan Thinh and Van Phu communes in the process of transportation of materials and machinery involved in the construction. Impact levels are considered low to moderate

throughout the construction period. Specific solutions to minimize this impact on the people around the sub-project area is required.

4.2.3.2. Specific effects during the construction phase

1. Ecosystem change due to dredging of Nam Cuong lake No.1

As for Nam Cuong lakes, since lake no. 1 is located downstream, it will be embanked first, lakes no. 2 and 3 later. The lake bed is dredged first, the slope and road later (as for the embankment construction). Sequence of embankment construction steps: (i) Identifying alignment centerline, establishing monitoring marks; (ii) Discharging water to lower the lake water elevation down to the dredging elevation +27.80m.

The dredging of sediment in the lake bed has influence on the lake ecosystem. Some sections in the lake 1 (19.26 hectares and the length of the embankment is 2,800 meters) has been reclaimed and cultivated as an agricultural ecosystem in the lake by the people. Lake bed sediment is basically Red River basin alluvial. The analysis results show that there are no heavy metals in sediment samples. Sediment dredging will affect aquatic and terrestrial ecosystems of the lake.

Impact is considered low level due to poor lake ecosystem, terrestrial ecosystems mainly of herbs, some shrubs, animals with amphibians, reptiles, mice. Under the water only some types of freshwater fish such as snails, crabs, mussels, natural fish...

Duration of impact is about 2 months of construction. After completion, lake bed ecosystem will be stable and balanced. Impacts on the ecosystem are considered to be mild.

Figure 46: Ecosystem of Nam Cuong lake 1 – pre-construction

2. Erosion, subsidence, sedimentation of streams and lakes

The construction can cause erosion, sedimentation of sand and soil due to excavation and dredging activities, consolidation of the embankment, construction of culvert... for embankment of Hao Gia, Khe Dai streams, Nam Cuong lakes no.1,2,3. Particularly, in the rainy season (from April to September, especially in May, July, August), the area of Hao Gia and Khe Dai streams are flooded rapidly on a large scale due to low water stream, with flooding depth up to 1.8 - 3.0m. A large amount of water from Ngoi Ong stream is drained through Nam Cuong lakes No.3 → No.2 → No.1 → Red River through the outlet. If the outlet can not drain a huge amount of water in time, the water rises rapidly, and a large volume of soil, sediment, building materials will be drifted with the current to the stream and lake bed when under construction.

Impact levels are rated as low to medium and short term in rainy season. Appropriate construction methods, construction time and construction quantity are necessary to reduce the risk of erosion, sedimentation of the streams and lakes during the construction.

Form Lake 1 to Red River

From Ngoi Ong to Lake 3

Discharge door from Lake 2 to lake 1

Discharge door from Lake3 to lake 2

Flooding in Hao Gia stream

Landslide in Hao Gia stream

Flooding in Khe Dai stream

Landslide in Khe Dai stream

Figure 47: Areas subject to landslides, subsidence and sedimentation

3. Impact of electric pole relocation

The total number of electric poles to be relocated for site clearance is 283 poles. The relocated electric poles are low-voltage ones. The removal and dismantling existing electric poles in the area will affect workers carrying out the works and nearby residents. The removal of electric

poles may cause hazards such as falls from overhead, electric shock, fire in offices and residential areas near the site. In addition, the relocation of electric poles also affects the proposed location of the electric poles (of the people or of the Government) on the acquired land. The level of impact is considered low, but has a lasting effect on the lives, health and mentality of workers and local people. Hazard can be mitigated by appropriate construction methods.

Figure 48: Existing electric poles in the land acquisition area

4. Impact from construction near railway

The construction area of resettlement site no.4 (3,963m2) and some sections of road No. 2 – the road connecting Bach Lam bridge to Van Phu bridge) pass through the Ha Noi - Lao Cai railway. The distance from the rails to the existing local road (2m) is about 10-30m. The construction near the railway may be unsafe for workers and local residents. Impact levels are considered low to moderate in the short term. Construction methods may minimize this impact.

Figure 49: Rails near the sub-project area

5. Impacts on production forest and planted forest of the people

The construction of 10/13 work items, except for the embankment of Nam Cuong lakes no.1, 2, 3, affecting the production forest land and plantation of people in the sub-project area. Total area affected is 255,508.6m^2. Specifically, appropriating 3,689.95m^2, 52,458.8m^2, 9,869.24m^2, 109,044.98m^2, 57,347.25m^2 for the construction of Hao Gia stream, Khe Dai stream embankment, road from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge, the road connecting Bach Lam bridge to Van Phu bridge, the road connecting Nguyen Tat Thanh intersection and Au Co intersection respectively. The area of forest acquired for the resettlement sites is 26,690.4m^2 and for the waste disposal asiterea is 14,362m^2. Currently, these

areas are planted with mixed wood trees, bamboo, acacia, banana, fruit trees, perennial trees... including young trees to 3-4 year-old trees, some 5-8 year-old fruit trees and perennial trees. When implementing the sub-project, trees will be cut down, affecting the life and production of people in the region (lower income and loss of daily work). In addition, the recovery of production forest land also poses the risk of insect stings, bees or other animals attacking workers and people around. Along with the construction of the work items in this area can also cause forest fire risk caused by workers such as smoke, fire, explosions in the construction area. The impact is considered low because these areas have small income value and the risk is not large because they often have people to work in the forest, with water sources The round can extinguish the fire if it occurs. Mitigation measures are detailed in the separate resettlement plan report and in the mitigation measures in the next chapter.

Table 42: Production forest areas affected by the subproject

No.	Work items	Production forest area recovered (m^2)
1	Nam Cuong lake 1 embankment	-
2	Nam Cuong lake 2 embankment	-
3	Nam Cuong lake 3 embankment	-
4	Hao Gia stream embankment	3689,95
5	Khe Dai stream embankment	52 458,8
6	Road from Dien Bien road to road connecting Bach Lam bridge to Van Phu bridge	9 869,24
7	Road connecting Bach Lam bridge to Van Phu bridge	109 044,98
8	Road connecting Nguyen Tat Thanh intersection to Au Co intersection	57 347,25
9 -> 13	Resettlement site no. 1 to no.5	26 690,4
	Total	**255.508,6**

Figure 50: Current status of production forest in the sub-project area

6. Transport interruption

The construction of sub-project work items may cause traffic disruption on roads no.1,2,3 and the embankment of Hao Gia and Khe Dai streams. Currently, these roads are earth roads, road along the embankment of Hao Gia and Khe Dai streams. Roads around roads no.1,2,3 are sparsely populated and they are not the only access road to the outside. These roads can be accessed by other inter-village roads. Affected people are nearby HHs and travellers on these roads. Therefore, the level of influence is considered to be low and possibly mitigated by appropriate measures.

Figure 51: Access roads (a, b) in the same sub-project area

7. Topographic elevation discrepacies between the construction works and houses and structures

There exists a difference between the elevation of the works and that of the access road or the structures and houses of HHs around the embankment of Nam Cuong lake, Hao Gia and Khe Dai stream (5/13 works). This difference affects the access road to structures and houses of 735 people, thus affecting the living and traveling of HHs in the area. The topographic elevation discrepancy may cause flooding in the area between the HH's house and the sub-project's construction works. The impact is considered not great. Mitigation measures can be applied in design and construction to limit this impact to the surrounding people.

Figure 54: Some images of tophographic elevation discrepancy

8. Local flooding during construction

Construction on partitioned sections may create local flooding points at construction sites and residential areas along the embankments, roads and resettlement sites of the sub-project during rainy season (from April to September, especially in May, July, August). The main subjects of impact are workers and surrounding HHs. The degree of flooding is considered low and can be minimized by appropriate measures.

Figure 52: Some images of flooding in sub-project area

Sensitive areas on construction sites

Specific impacts at sensitive points are shown in the following table:

Table 59: Specific impacts in each sensitive area by the sub-project work items

No.	Sensitive areas	Description	Impacts
	Nam Cuong lakes 1,2,3 embankment		
1.	Multi-purpose communal house 	- Located in Cau Den residential group, at intersection of Le Chan road and lake 2 walkway. - The distance to the construction site is about 40m, at TD14 pile. - Number of attendants: 130 people in the ward - Frequency: once a week in the evenings. - Distance to construction site is about 40m, at TD14 pile	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Restricted access to the communal center - Traffic accidents risk - Activities of the local people - Conflict with workers

No.	Sensitive areas	Description	Impacts
2.	Medical Station 	- Located on the road near the residential area along lake l 1 in Nam Tho village - Distance to the construction site is 50m, at TD11A pile. - Number of visitors: 20 people / month - Working hours: day time but 24/24 on duty	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access to emergency medical services - Traffic accident risk - Conflict with workers - Medical examination and treatment activities
3.	Communal house of Cau Den hamlet 	- Located at the junction of Le Chan road with lake 2 walkway, located on the embankment of lake 2 at Pile no.3. - This communal house is venue for cultural activities of Cau Dien hamlet - Opened mainly in the evening	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access to meetings cultural activities - Traffic accident risk - Conflict with workers.
4.	Nam Cuong Primary School 	- Located on the road along the Nam Cuong lake, about 300m from the embankment of lake 2, near TD10 pile - Number of pupils is over 400, 25 teachers - Working hours: 6h30 - 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Classes of pupils - Picking up children at the school - Limited access - Traffic accident risk - Conflict with workers
5.	Son Ca Kindergarten 	- Located in Cau Den hamlet, Nam Cuong ward, about 230m from TD9 pile in lake 2 - Located on the existing concrete road of lake 2 - There are over 300 kids, 25 teachers in the kindergarten - Working hours: 6h30 - 7h30, 16h30-17h30. - Located in a fresh environment	- Dust, gas emissions - Noise, vibration - Wastewater - Solid waste - Teaching and learning activities - Limited access - Traffic accident risk - Conflict with workers
6.	Martyrs' Cemetery 	- Nam Tho residential quarter, Nam Cuong ward, about 20m far from the construction site of lake 2. - There are 48 graves of martyrs - Located on the existing concrete road of lake 2 - Visits are made only at the big ceremonies of the Government and in the beginning and at the end of the year for cleaning and repair of the graves.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Visits and ceremonies

No.	Sensitive areas	Description	Impacts
7.	Mau Temple, Van Thang pagoda and temple 	- Located on existing concrete piles at TD3 and TD4 piles of lake 3 and lake 2 - Place of cultural activities of the community during festival season, especially in January of lunar calendar	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Festival activities and holidays in the year
8.	Nam Cuong residential area 	- Residential area in lake 3 (TD19, TD5, TD7, TD14 piles); about 10 – 100m from the construction site - Residential area in lake 2 (TD6 - TD9, TD32 – TD36 piles); about 5 – 100m from the construction site - Residential area in lake 1 (TD13 – TD17, TD31 and TD6A – TD19A piles); about 5 – 50m from the construction site - Mainly affect the back of people's houses	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Living and production activities of people
	Hao Gia stream embankment		
9.	Residential area in Hao Gia stream 	- Distance from the nearest house to the site is 10-100m at T4, TD2 – TD3, T40, T54, T123 – T125 piles - Back of the residential area is affected - Yen Thinh market at Km 6 of Yen Thinh ward, Yen Bai Newspaper Office located on the embankment of Hao Gia stream but the embankment has been completed to Khe Lap bridge	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers - Living, business and production activities of local people
	Khe Dai stream embankment		
10.	Yen Ninh Medical Station 	- In group 56, Yen Ninh ward, 400m from the construction site. - Behind is the Khe Dai stream embankment - Number of visitors: about 30 persons/month - Working hours: Office hours and 24/7 on duty. - People live on both sides of the embankment.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access to medical services and emergency treatment - Traffic accident risk - Conflict with workers - Activities of patients, nurses, doctors
11.	Minh Tan ward market	- In 26 group, Minh Tan ward, about 80m from the construction site - Number of regular visitors: 500 people	- Dust, gas emissions - Noise, vibration - Wastewater - Waste

No.	Sensitive areas	Description	Impacts
		- Main activity: dealing goods - Opening hours: from 5h00 till 18h00 every day - A hustling market of the ward. People live on both sides of the route. Environment is clean.	- Limited access by dealers and local people - Traffic accident risk - Conflict with workers. - Living and trading activities of local people.
12.	Kim Dong Primary School 	- In group 31, Minh Tan ward, 5m from the construction site in the back - Opening time: weekdays - Total 1,000 pupils and 50 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at school - Extra-curricular activities
13.	Hoa Hong Kindergarten 	- In group 50, Minh Tan ward, 5m from the construction site. - About 300 kids and 25 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at school - Extra-curricular activities
14.	Residential Area 	- The shortest distance is 10-200m from L89 to L92 piles.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people
	Road no.3 – from Nguyen Tat Thanh intersection to Au Co intersection		
15.	Nguyen Tat Thanh High School 	- In Luong Thinh 2 hamlet, Tan Thinh ward, about 30-100m from the construction site - About 800 pupils and 34 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at the school - Extra-curricular activities

No.	Sensitive areas	Description	Impacts
16.	Nguyen Hue High School 	- In Luong Thinh 2 hamlet, Tan Thinh ward - About 300 pupils and 25 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers. - Picking up children at the school - Extra-curricular activities
17.	Tan Thinh Church 	- Thanh Hung 1 hamlet, Tan Thinh ward, about 50m from the construction site. - Number of visitors: 200/630 parishioners - Opening hours: 19h00 at weekdays; 8h00 and 19h30 at weekend	- Dust, emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Religious activities of the community
18.	Nguyen Trai Primary School 	- In Luong Thinh 2 hamlet. Tan Thinh ward - About 300 pupils and 25 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at the schools - Extra-curricular activities
19.	Tan Thinh Medical Station 	- In Thanh Hung 3 hamlet, Tan Thinh ward, about 400m from the construction site - Located on the construction road, sparsely populated, 2.5-3m earth road. - Number of visitors: about 30 persons/ month, - Working hours: office hours and 24/7 on duty.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Medical examination and treatment
20.	Residential Area 	- Residential area (85, 66A, 49, ND9, A42, A43, 80, 88, 76 piles), about 30 – 100m from the construction site	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people

No.	Sensitive areas	Description	Impacts
	Road No.2 – connecting Bach Lam bridge to Van Phu bridge		
21.	Vocational college 	- Located on inter-communal road, about 400m from the construction site. - Sparse population. - About 500 students - Office hours: 24/5. Weekend off.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of students and teachers - Extra-curricular activities
22.	Communal House of Van Phu hamlet 	- In Van Phu hamlet, about 1km from the construction site - Number of attendants: 60 people - Frequency: once a week in the evening. - Sparse population, vegetation includes mainly brushwood, small trees	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people
23.	Van Phu Primary and Secondary School 	- Located on the construction road, at 2A pile near intersection at Km4. - About 1080 students. - Sparse population, vegetation includes mainly brushwood, small trees; no drainage system. - Opening hours: from 6h30 - 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers. - Picking up children at the school - Extra-curricular activities
24.	Cummunal House of Tuy Loc hamlet 	- In Tuy Loc hamlet, about 70m from the construction site; - Sparse population, vegetation includes mainly brushwood, small trees. - 50 people - One night every week.	- Dust, emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people
25.	Van Phu temple and pagoda 	- In Tuy Loc hamlet, sparse population, mainly brushwood, small trees along the route; - Number of attendants: 50 people - Frequency: annual Buddhist ceremonies such as Buddha's birthday, ghost festival, quiet-seeking rituals, etc.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Religious activities of local people and visitors

No.	Sensitive areas	Description	Impacts
26.	Residential area 	- Residential area (Km 0-Km 0+400 at TD1, TC2), about 10 – 20m from the construction site - Residential area at Km 3-4 (piles 29, 30, 33, 34), about 30-100m from the construction site. - Residential area at Km 4 – Km 5 (2A, TC4, TC5, 24-28, 35-39 piles), about 10 – 50m from the construction site.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people
	Road no.1 – from Dien Bien road to connection road between Bach Lam and Van Phu bridges		
27.	Residential area 	- Residential area (at TD1, TD3, TD6 piles), about 0 - 20m from the construction site	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people

4.2.3.4. Risks and incidents during construction period

1. Accidents at work

In general, labor accidents may occur in any construction phase of any sub-project's component. The impact is rated from low to moderate, affecting health, life and mentality of workers. Mitigating measures may help to prevent these labor accidents. Labor accidents are typically caused by:

- People working on the embankment (Hao Gia stream, Khe Dai stream, Nam Cuong lake) are at risk of drowning due to negligence or fatigue or failure to comply with labor safety regulations when carrying out the construction in these areas.
- Severe weather conditions such as heavy rain, storms and floods
- Environmental pollution may cause fatigue, dizziness or faint to workers when thay are at work, operating equipment, unloading materials and equipment, dredging, digging, building, material handling;
- Landslide in deep excavations, sloping terrain;
- Injury caused by insect bite or animal bite;
- Dismantle existing bridges, houses and structures on appropriated areas; accidents may occur from their negligence;
- Falling from the height when removing electric poles or other infrastructure objects;
- At the work site on rainy days, the probability of labor accidents is even higher: slippery land makes it easy to slip, electricity problems are easier to occur, soil is soft and easy to slump causing incidents for people and construction machines and equipment.

2. Traffic accident

The risk of traffic accidents often occurs to workers, people and travellers on transportation routes and at the construction site. The impact level is considered low to moderate, but the impact of this risk on life, mentality and health of the victims is considerable. Appropriate

measures and internal and external construction regulations are necessary to limit these risks.

The risk of traffic accidents is principally attributable to:

- Overloading
- Over-speeding, lack of attention during travelling, especially when crossing residential areas.
- Landslide, especially at the turns and intersections.
- During the construction of the sub-components, high traffic volume in the sub-project area and poor quality of the roads may cause collisions to drivers and travellers.
- Accidents caused by crossing the railway near the consruction site of road no.2 and resettlement site no.4 due to have not the construction and traffic signs at the constructiion site or near railway location, no a qualified technical staff to supervise and guidle construction activitives, during transportation, loading and unloading of construciton materials and wastes near the railway...

3. Spilling of materials and chemicals, causing fire and electric shock

Dust, toxic chemicals, volatile gases from the spill of materias, fuel, chemical into the construction site or on the transportation road will affect workers, people nearby and travellers, causing fire, explosion, or even death or permanent injury. The level of impact is considered low to moderate. Specific measures must be taken and prepared in the prevention and handling of fuel and chemical spill, fire and electric shocks to minimize this impact. Incidents referred to are:

- Gasoline and oil leak during storage will release volatile organic solvents to the environment, which may cause fire and explosion at the fuel depot and strongly affects the air quality in the surrounding area.
- The emission of these gases also increases the amount of greenhouse gases in the atmosphere.
- In performing the repair works, worker's inattentiveness (touching electric circuit, smoke, start fire, etc.) may also cause fire and explosion.
- Fuel (such as diesel oil, gasoline) often stored at the site is a major source of fire and explosion. Especially when these warehouses (or yards) are located near heaters or where there are many people, vehicles passing by.
- A fire or explosion hazard may result from electrical faults.
- Electric shock and injury caused by worker's negligence.

4. Uncorvering archaeological and historical relics or tombs

During the construction of the embankment pit, roads or resettlement sites, underground archeological, historical relics or tombs may be revealed. These risks are considered low but may occur. These archaeological discoveries, if prepared beforehand, will enable proactive response and rapid reaction.

5. Other incidents

Apart from these incidents, other incidents may also occur during the construction process, which will directly affect workers and people living in the surrounding areas. The level of impact is low, but it may seriously affects the life, health and spirit of the victims, disrupt the construction progress and puts pressure on the local medication and emergency care. Specific measures might help prevent and mitigate impacts from this incident. The incidents include:

- Drown when falling into the culvert.

- Food poisoning affecting health and life of workers
- Outbreak of plagues at the construction site/ camps and in the residential area such as dengue fever, HIV / AIDS, cholera, dysentery, skin diseases.

4.2.4. Impacts during the peration phase

4.2.4.1. Generic impacts

1. Air environment

13 work items of of Nam Cuong lake 1,2,3, Hao Gia stream, Khe Dai stream embankment, roads no.1,2,3 and resettlement sites of the sub-projects when put into operation shall have no major impact on the environment and the surrounding population. However, when these works are put into operation, there will be gas and noise emissions from vehicles.

Noise and fumes from vehicles moving on the embankments and roads containing toxic substances such as SO_2, NO_2, CO, CO_2, THC, dust, etc. may affect the health of travellers and some HHs in the vicinity; but because the quantity of these emissions is not very large and the area is clear, the impact is minor. In particular:

Impacts from gas and dust

The operation of vehicles such as motorcycles, cars ... on the lines of Nam Cuong lake, Hao Gia stream, Khe Dai stream embankments, roads no.1,2,3 and resettlement sites, the traffic flow and the increased traffic density will generate gas emissions, including:

- Road vehicles are the main cause of high concentrations of CO, especially in the areas where these vehicles pass.
- Hydrocarbon compounds (CmHn) derive from engine exhaust or evaporation of light compounds from fuel. Under appropriate weather conditions, NO_2, SO_2... will be transformed to secondary pollution: acid rain or fog on a wide range.
- The rise of NO_2 increases rapidly as the temperature rises from the internal combustion engine system, car is a typical example. Temperature in the car engine may reach 500 – 800^oC.

Impact of noise and vibration

Noise and vibration are generated by increasing volume and frequency of transportation on Nam Cuong, Hao Gia, Khe Dai embankments and road from Dien Bien road to the road from Bach Lam bridge to Van Phu bridge, the road connecting Bach Lam bridge to Van Phu bridge, the road from Nguyen Tat Thanh intersection to Au Co intersection, after they are completed and brought into operation. Average noise levels for each type of vehicle are: motorcycle 60-70dBA, 4-7 seat car 60-62dBA, bus, van with less than 50 seats 72-74dBA, light truck 75 - 88dBA. The overall noise level of the vehicles on the road depends on the noise level of each vehicle, traffic volume, vehicle composition, road characteristics and surrounding terrain. Noise level of the vehicle is often unstable and varies very rapidly at the time of operation. Vibration level ranges from 62 to 76dBA from time to time.

However, in the beginning of operation phase of Hao Gia and Khe Dai stream embankments and new roads, the transport volume is still low, so the noise level is considered negligible. In the coming time, as the density and traffic volume increase, a specific plan with necessary actions need to be drawn up to minimize noise and vibration in the sub-project area.

2. Impacts of wastewater

Wastewater is mainly rainwater that spills over the entire surface and sweeps pollutants from vehicles and travellers. This runoff is collected at the pre-drainage outlet to the sump. As a result, part of garbage and dust will be deposited and collected periodically. The impact of wastewater is considered to be absent.

3. Impacts of garbage

Garbage is mainly generated by people living along the embankments and roads, travellers and business entities along the embankmenst. In the locations and streets where waste collection sites are arranged, these impacts are considered to be manageable.

4.2.4.2. Specific effects during operation

Once the sub-project items have been completed, they will change the former terrain of the sites, creating a new landscape environment. However, the sub-project items will have some impacts, such as (i) change of topography, change of flow, (ii) transport on new roads.

1. *Impact from terrain and flow change*

The areas of Hao Gia stream, Khe Dai stream and Nam Cuong lake embankments are often severely eroded and subject to flood erosion with soft, loose and unstable structures. The construction of embankments must demolish, change the land use purpose, fruit trees land, forestry trees land, vacant land, etc., and change the landscape and terrain of the area. The uneven terrain subject to frequent landslide and erosion will be changed into a flat, firm embankment that is free from landslide and erosion; In addition, arrangement of drainage ditches on both sides to the manholes of natural drainage ditches protects lives and properties of people living along the embankments and provides walkway for local people as well as increase the land value in the area.

The dredging of streams and lakes and construction of embankments along Hao Gia, Khe Dai stream, around Nam Cuong lakes 1,2,3 as well as technical altenatives for embankment design (slope, retaining wall on both sides) for construction of Hao Gia stream embankment (slope), Khe Dai stream embankment (combining 2 methods for specific section), lake embankment (slope), for direct reinforcement on the embankment. Specifically, the embankment structure for a block is 11.7m, M200 reinforced concrete frame system, vertical beam spaced 2.45m 2mx2m size, horizontal beam 3.5m apart 0.3mx0.2m size, M200 concrete placed between frames, concrete lining M100 thickness 5cm; Reinforced concrete beam, 0.5m high, 0.6m wide with foot of embankment, M100 concrete wall lining, 5cm thick, anti-settlement joints coinciding with those of the embankment at an interval of 11.7m, creating stability, reducing water pressure on the embankment, preventing erosion from the impact of the flow and long-term flooding. The technical design of the embankment as mentioned above will not change the hydraulic flow regime, so it does not affect the current flow of Hao Gia and Khe Dai streams. In addition, the completion of embankment works will facilitate the re-alignment, smooth flow, improved drainage in the flood season and ensure the stability of the works.

Figure 53: Images of slope embankments

2. Traffic and transport activities

Road safety is considered to be the main impact during the operation of roads no.1, 2, 3 of the sub-project. In the early years of operation, residents may use vehicles such as bicycles, motorbikes, cars, non-motorised vehicles, etc. on the lanes and they may not comply with traffic signs, road signs, driving at high speed and facing the risks of traffic accident. This is due to low awareness and bad habits of local people, who are not familiar with the rules on road safety. It is necessary to focus on reviewing the practical road use as well as the subsidence monitoring on the new roads, monitoring the compatibility of the existing topography with the construction. After a short time of operation, when the traffic quantity increases, road safety hazards on the roads will emerge and mitigation measures need to be considered and addressed in the longer term.

The reason is due to the awareness and habits of people in the area of safety regulations, the practice of road using as well as the settlement monitoring on new roads, monitoring the response capability of construction on the existing geological. However, after a short time, when the transport flow is higher, arising the risks of traffic accidents on the roads. At the same time, mitigation measures need to be considered and addressed in the longer term.

Figure 54: Images of disobeying traffic regulations

In addition, the completion of the road works from Dien Bien road to the Red River side road, road from Bach Lam bridge to Van Phu bridge, the road connecting Nguyen Tat Thanh intersection to Au Co intersection will create a comprehensive network connecting both sides of Red River to the NH.37, HN.70, Ha Noi - Lao Cai Expressway, NH.32, etc., thus paving the way for economic and social development, facilitating the trade of goods and services in the sub-project area in particular and Yen Bai Province in general.

3. Change the land use purpose on both sides of the embankment, roads and resettlement sites

The agricultural land along the two sides of the roads the embankments tends to be converted into residential land, thus reducing the area of agricultural land, affecting the agricultural production and supply of foods in the area. However, the cultivation in these areas are, for the most part, inefficient and produce unstable or low economic value. The conversion of land use purpose to residential land increases the value of the current land plot and that of the land inside. The level of impact is rated as medium to high, with significant changes to the regional economic and social, stimulating trade and service development and value added in the short term. In general, this impact is viewed as a positive effect rather than a detrimental effect and the detrimental impact is considered to be a minor impact, affecting the general population in the region and the city. Mitigating measures will alleviate these adverse effects.

Figure 55: Changes in land use purpose before and after the sub-project

4.2.4.3. Risks and incidents during the operation phase of the sub-project

1. Incidents of embankment erosion, bridge breaking, road settlement

When the works come into operation, landslide, cracked and broken bridge surface may occur from impacts of floods, earthquakes, improper construction methods and technical requirements. This will take heavy tolls of lives and properties of the local people and travellers.

The main reason is from heavy rain, storms, floods in the sub-project area and responsibility and capacity of the contractor and his compliance with construction regulations and standards. Embankments erosion and road settlement have been surveyed and evaluated in geological, topogrphical, hydrological aspects as well as traffic scale, therefore, these risks and incidents are considered low and unlikely.

Figure 56: Embankment collapse and road subsidence

2. Falling into the lakes, streams and drowning in the sewers

In the Hao Gia and Khe Dai stream embankments as well as the Nam Cuong lakes 1, 2 and 3 embankment areas, guardrail has been set up in some sections on the top of the embankment with a height of 90 cm in 3 Nam Cuong lakes and about 80cm in the embankment area of Hao Gia stream and Khe Dai stream. Rails are made of steel, electrostatic powder coating in gray. However, in the rainy season, children may slip into Hao Gia, Khe Dai streams and Nam Cuong lakes and drown, or vehicles may fall down on the streams and lakes. In addition, dangerous places include the faucet pipe into he lake 3, from lake 3 to lake 2, from lake 2 to lake 1 and outlet sluice from lake1 to Red River. Normally, the rate of flow in drainage culverts is great, especially in heavy rain, so fatality is possible if falling into these drainage culverts. Warning measures and guidance to people/ travellers in these locations are required.

3. Railway or road accidents

Accidents on Hanoi - Lao Cai railway passing through the begnning section of road no.2 - connecting from Bach Lam bridge to Van Phu bridge and resettlement site no.4 may occur when people come to live here. Besides, road traffic accidents on roads no.1,2,3 of the sub-project may also occur during the operation of the work items. Subjects of the impact are people who live in the surrounding area and travel on the roads. The impact period is maintained during the operation phase.

Specific impacts at sensitive points

During the operation period of sub-project items, there is no impact on sensitive points within the range of work items. Therefore, the impact on sensitive points during the operation phase is considered to be absent.

CHAPTER 5. MITIGATING MEASURES FOR NEGATIVE IMPACTS

This Chapter addresses mitigating measures for impacts from the sub-project's components arising from the design, land acquisition, construction and operation of the work items. Specific mitigating measures are presented in the Environmental Codes of Practice (ECOPs), which will be adopted to minimise the general impacts of the works.

Site-specific impacts require specific mitigating measures for both construction and operation phases beside the general impacts defined in ECOPs.

5.1. MITIGATING MEASURES FOR THE DESIGNING PHASE

The Hao Gia stream, Khe Dai stream, Nam Cuong lakes 1, 2, 3 embankments, alignments and land acquisition areas of the roads and resettlement sites are located along the streams and lakes to avoid eviction of local people's solidly built houses or otherwise adjust the alignment in such a way as to minimise land acquisition by means of technical methods and construction methods and at the same time ensure the smooth curve of the embankment lines without being broken as well as the drainage capacity and erosion control.

The design of embankments, roads and resettlement sites has been calculated with due regard to the master plan, socio-economic development plan, thorough surveys of hydraulic regime (flood, flow regime, etc.), geological and topographical conditions and consultation with local governments and people in the sub-project area to ensure the safety, convenience and efficiency of the flood control embankment, flood drainage capacity of Hao Gia stream, Khe Dai stream, Nam Cuong lakes, transport and communication demands and future road expansion.

The detailed design of the works covers all aspects of sludge and sediment management, transportation of sludge in covered trucks and disposal of sludge and soil in previously prepared locations.

As for the roads: designing road surface drainage system, arranging manholes along the roads and standard traffic signs.

5.2. MITIGATION MEASURES FOR IMPACTS IN THE PRE-CONSTRUCTION AND LAND ACQUISITION PHASES

5.2.1. Mitigation measure from bombs and mines

Bomb and mine clearance will be conducted immediately after completion of land acquisition and before the demolition and levelling works. A military unit or another competent entity will be contracted by the Project Owner to carry out the demining and all associated costs will be included in the contractor's construction costs.

Ensure safety distance and danger indicators for people during the execution of the works in accordance with QCV 01:2012/BQP – National technical regulations for clearance of bomb, mine and explosive and QCVN 02: 2008/BCT – National technical regulations for safe transportation, storage, usage and disposal of industrial explosives.

5.2.2. Mitigation measure from from land acquisition and resettlement

Key issues in this period relate to compensation, subsidy and resettlement for people whose land, house, income and properties are affected. The compensation and subsidy for land

acquisition will adhere to the sub-project's resettlement plan25.

Resettlement plan (RP) of the sub-project has been compiled with a view to minimising the impacts relating to land acquisition and resettlement with the main contents as elaborated below:

- The Project Owner will coordinate with Yen Bai City Land Stock Development Center, Province Department of Natural Resources and Environment, People's Committee, City Department of Natural Resources and Environment, relevant commune/ward People's Committees, HHs and individuals whose land and accompanying properties are located in the eviction area to notify and guide the measurement and declaration of properties in a detail-oriented, accurate, open manner and approve an appropriate compensation plan.
- Propagandise to the AHs the compensation, subsidy and resettment policies of the sub-project.
- Propagandise about the rights and responsibilities as prescribed by laws.
- Publicise the compensation rates for each type of loss to AHs.
- Publicise and notify the accurate compensation, subsidy and resettlement quantities (if any) of each HH affected by the sub-project.
- Make compensation and subsidy payment to the right people and within the given time-frame.
- Co-ordinate with local governments in the event of dispute to ensure successful land acquisition.
- Removal of graves must be completed before commencement of the construction works in compliance with the Resettlement Plan approved by World Bank.
- The selection of resettlement plan has been discussed with AHs to minimise impacts and facilitate economic recovery. In the meantime, mitigation of temporary impacts during the construction phase has also been considered and proposed in order to avoid and minimise these impacts during the execution of the sub-project.
- The sub-project's resettlement policy framework has been prepared in line with WB's policy on involuntary resettlement (OP.4.12) and Vietnamese Government's legislations on compensation, subsidy and resettlement upon land acquisiton by the Government. The resettlement plan is in line with this policy framework.
- Livelihood recovery program is an important part of the compensation, subsidy and resettlement plan with a view to stabilising livelihood and ensuring an equal or better income for AHs. Livelihood recovery program will involve 679 eligible AHs based on survey of support demands. The proposed activities include (i) vocational training; ii) loan access, and iii) job creation.
- Consult with the local community and authorities to provide information and consultancy on the resettlement plan and opportunities for engagement in resettlement planning, performance and supervision.

[25] This resettlement plan is presented in a separate report.

- Total estimated cost for execution of this resettlement plan is approximately **93,318,000,000** VND, which must be allocated in full amount to pay to HHs entitled to compensation and subsidy prior to the commencement of the construction works cần. This cost is inclusive of compensation for land, architectural objects and other properties as well as subsidy for income recovery program, costs for supervision, assessment and establishment of compensation council. Resettlement costs will be updated at the time of compensation.

5.3. MITIGATION MEASURES IN THE CONSTRUCTION PHASE

5.3.1. Environmental Codes of Practice (ECOPs) for mitigation of generic impacts

As part of the Environmental and Social Management Plan (ESMP) for the subproject these general measures have been translated into a standard environmental specification to be incorporated into bidding and contract documents. These are referred to as Environmental Codes of Practice (ECOPs), and will be applied to mitigate typical impacts of the subproject's civil works during the pre-construction and construction phase.

The ECOPs describe typical requirements to be undertaken by contractors and supervised by the construction supervision consultant during construction. The ECOPs will be incorporated into the bidding and contract documents (BD/CD) annexes. The measures identify typical mitigation measures for the following aspects:

- Impacts of dust;
- Air pollution;
- Noise and vibration;
- Water pollution;
- Solid waste;
- Chemicals or hazardous wastes;
- Traffic management;
- Interruption to utility services;
- Restoration of affected areas;
- Worker and public Safety;
- Communication with local communities about subproject environmental issues;
- Health and Safety for workers and the public;
- Chance finding procedures
- Fire hazard due to accident.

5.3.2. Mitigating measures for specific impacts in the construction phase

Potential impacts of the work items are considered as moderate, temporary and local, most of which may be mitigated through specific mitigating measures defined in ECOPs and supervised by the Project Owner, PMU and CSC, while main responsibility rests with the contractor. Mitigating measures for specific impacts in this area are (i) Dredging lake 1, (ii) Embankment erosion and subsidence, stream and lake sedimentation (iii) Removal of electric poles, (iv) Impacts from construction near railway, (v) Impacts on production forest, (vi) Traffic

disturbance, (vii) elevation discrepancy between the works and local people's houses, (viii) local flooding, and (ix) sensitive areas, as set out below:

(i) Mitigating impacts on the eco-system from dredging lake 1:

- Selecting season-based construction time for optimal construction conditions.
- Consulting with local people and authorities and the contractor (if any) for proper planning.
- Setting up boards guiding the environment and landscape protection.

(ii) Mitigating impacts from embankment erosion and subsidence, lake and stream bed sedimentation

- Arrange appropriate construction site along the embankment route, near the temporary road connecting to the road to foundation pit.
- Arrange pile and stop plank fabricating and gathering yards and mixing machines in such a way as to facilitate the supply and transportation of materials to the worksites.
- Arrange soil storage yards along the embankment routes to reduce the transportation distance and to ensure smooth traffic and sites for adjacent work items.
- Select appropriate construction methods such as arrangement of machines to drive bamboo piles in the embankment sections next to residential areas to avoid affecting public works and houses of local people;
- Arrange rainwater drainage and solid waste settlement facilities on the construction sites to reduce solid waste settlement; conduct regular dredging and monitoring, especially in cases of rain and flood.
- Prepare concrete construction plan and make public the work schedule; works should be prioritised in dry season.
- Closely watch weather forecast to carry out the works as per the plan and to the required quality.

(iii) Mitigating impacts from displacement of electric poles

- Designate technical staff to instruct the removal of electric poles
- Personnel in charge must be qualified in professional skills as required by the works, be trained and granted with electric safety certificate.
- Communicate information and exchange personnel and technical skills with the local power supply agency for co-ordination.
- As for electricity grid, structures of electricity grids must be dismantled and recovered and site be reinstated within 6 months from the separation of the electricity grid from the electricity system.
- Remove and erect electric poles in accordance with the plan so that people are assured of their safety.
- The owners of the works must make plan for management and dismantling of the power works no longer in use.

(iv) Mitigating impacts from construction near railway

- Inform the railway management company of the construction activities and their potential impacts such the risks of interference with the railway train schedule and railway traffic safety, and the detail construction work schedule at least 01 month before construction starts.
- Set up construction and traffic warning signs at the construction site.
- Set up barriers around the construction area to separate working area with the railway (fence 2.5 m tall).
- Construct the sewer under passing the railway using safe tunneling method.
- Deploy a qualified technical staff to supervise construction activities near the railway.

- Only execute construction activities when there is no train schedule.
- Prohibit scattering of construction material and wastes near and on the railway.
- Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and during transporting materials crossing the railway.
- Immediately collect any domestic wastes and construction spoils around and near the railway and dispose in a designated site.
- Slow down when executing the works or transporting materials to allow time for observation and give signals;
- When a train is coming or going to come, stop at 5m away from the rails as a train travelling at a very high speed may take anyone nearby with it;
- Observe in both 2 directions and identify the utmost safety position; when a red/yellow light is on or horn is sounded, stop and wait for the train to pass by.
- If crossing the rails, speed up to rush to the other side of the road.
- If the engine breaks down when crossing the raila and gets stuck there, if no train is coming, ask passers by, police of railway officers for help.
- If a train is coming, get off the vehicle immediately without wasting time taking anything in the vehicle and run away from the rails in the opposite direction with the train to avoid objects and debris that may cause injury.

(v) Mitigating impacts on the production forest land:

- Specific measures are presented in the Resettlement Plan;
- To ensure that the compensation, subsidies and resettlement support rates are compliant with the donor's policies and the laws of Vietnam;
- Support the HHs to stabilise their livelihood and production through training courses and occupation change if HH members are in the working ages.
- Firing, smoking or other fire hazards are strictly prohibited within the construction site and the dominant forest production area;
- Adhere strictly to this collection, used for the project.
- Ensure the adequacy of land use allocations for the management, conservation, and sustainable development of forests.
- Propagate people in forest protection and development.

(vi) Mitigating impacts from traffic disturbance

- Make detailed construction plans and make them public 2 weeks before the construction;
- Completely finish a work item on the worksite before starting work on others;
- Arrange signposts and staff guiding traffic flows (if necessary);
- Refrain from transporting and unloading construction materials and waste materials on the main routes in rush hours;
- Regulate the vehicles to and from the work sites and appropriate construction quantities;

(vii) Mitigating impacts from elevation discrepancy between the works and local people's house

- Study the existing terrain when surveying for detailed design preparation and select suitable technical option
- Consult with local people and authorities in dealing with elevation discrepancy prior to carrying out the works.
- Design the connection from the designed works to local people's houses to ensure entrance to house/works
- Support HHs with lower elevation than the design elevation to provide connection and reduce elevation differences.

(viii) Mitigating impacts from local flooding

- Arrange temporary settling holes and rainwater drainage system on the construction site;
- Arrange pumps with suitable capacity to pump water when necessary and to prevent inundation of materals and equipment;
- Prepare plans for dealing with flooding on the worksite;
- Closely watch the weather to prepare appropriate construction methods.

(ix) Mitigating impacts on sensitive areas

Mitigating impacts on sensitive areas on the construction lines are presented below:

Table 43: Mitigation measures for sensitive areas

No	Sensitive areas	Description	Impacts	Mitigating measures
	Nam Cuong lakes 1,2,3 embankment (7 sensitive areas and residential areas)			
1.	Multi-purpose communal house 	- Located in Cau Den residential group, at intersection of Le Chan road and lake 2 walkway. - The distance to the construction site is about 40m, at TD14 pile. - Number of attendants: 130 people in the ward - Frequency: once a week in the evenings. - Distance to construction site is about 40m, at TD14 pile	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Restricted access to the communal center - Traffic accidents risk - Activities of the local people - Conflict with workers	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.
2.	Medical station 	- Located on the road near the residential area along lake l 1 in Nam Tho village - Distance to the construction site is 50m, at TD11A pile. - Number of visitors: 20 people / month	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access to emergency medical services	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise traffic flows at the

No	Sensitive areas	Description	Impacts	Mitigating measures
		- Working hours: day time but 24/24 on duty	- Traffic accident risk - Conflict with workers - Medical examination and treatment activities	outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.
3.	Communal house of Cau Den hamlet 	- Located at the junction of Le Chan road with lake 2 walkway, located on the embankment of lake 2 at Pile no.3. - This communal house is venue for cultural activities of Cau Dien hamlet - Opened mainly in the evening	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access to meetings cultural activities - Traffic accident risk - Conflict with workers.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.
4.	Nam Cuong Primary School	- Located on the road along the Nam Cuong lake, about	- Dust, gas emissions - Noise, vibration	- Notify the community and the School Managing Board of the construction

No	Sensitive areas	Description	Impacts	Mitigating measures
		300m from the embankment of lake 2, near TD10 pile - Number of pupils is over 400, 25 teachers - Working hours: 6h30 - 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Wastewater - Waste - Classes of pupils - Picking up children at the school - Limited access - Traffic accident risk - Conflict with workers	schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.
5.	Son Ca Kindergarten 	- Located in Cau Den hamlet, Nam Cuong ward, about 230m from TD9 pile in lake 2 - Located on the existing concrete road of lake 2 - There are over 300 kids, 25 teachers in the kindergarten - Working hours: 6h30 - 7h30, 16h30-17h30. - Located in a fresh environment	- Dust, gas emissions - Noise, vibration - Wastewater - Solid waste - Teaching and learning activities - Limited access - Traffic accident risk - Conflict with workers	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rudh hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent

No	Sensitive areas	Description	Impacts	Mitigating measures
				dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.
6.	Martyr's cemetery 	- Nam Tho residential quarter, Nam Cuong ward, about 20m far from the construction site of lake 2. - There are 48 graves of martyrs - Located on the existing concrete road of lake 2 - Visits are made only at the big ceremonies of the Government and in the beginning and at the end of the year for cleaning and repair of the graves.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Visits and ceremonies	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.
7.	Mau Temple, Van Thang pagoda and temple 	- Located on existing concrete piles at TD3 and TD4 piles of lake 3 and lake 2 - Place of cultural activities of the community during festival season,	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise traffic flows at the

No	Sensitive areas	Description	Impacts	Mitigating measures
		especially in January of lunar calenda.	- Festival activities and holidays in the year.	outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.
8.	Nam Cuong residential area 	- Residential area in lake 3 (TD19, TD5, TD7, TD14 piles); about 10 – 100m from the construction site - Residential area in lake 2 (TD6 - TD9, TD32 – TD36 piles); about 5 – 100m from the construction site - Residential area in lake 1 (TD13 – TD17, TD31 and TD6A – TD19A piles); about 5 – 50m from the construction site - Mainly affect the back of people's houses	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Living and production activities of people.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.

No	Sensitive areas	Description	Impacts	Mitigating measures
	Hao Gia stream embankment (residential area)			
9.	Hao Gia stream residential area 	- Distance from the nearest house to the site is 10-100m at T4, TD2 – TD3, T40, T54, T123 – T125 piles - Back of the residential area is affected - Yen Thinh market at Km 6 of Yen Thinh ward, Yen Bai Newspaper Office located on the embankment of Hao Gia stream but the embankment has been completed to Khe Lap bridge	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers - Living, business and production activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.
	Khe Dai stream embankment (4 sensitive areas and residential area)			
10	Yen Ninh ward medical station 	- In group 56, Yen Ninh ward, 400m from the construction site. - Behind is the Khe Dai stream embankment - Number of visitors: about 30 persons/month - Working hours: Office hours and 24/7 on duty.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access to medical services and emergency treatment - Traffic accident risk	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting

No	Sensitive areas	Description	Impacts	Mitigating measures
		- People live on both sides of the embankment.	- Conflict with workers - Activities of patients, nurses, doctors	works. - Arrange signposts and lights at two ends of and along the temporary bridge at night.
11	Minh Tan ward market 	- In 26 group, Minh Tan ward, about 80m from the construction site - Number of regular visitors: 500 people - Main activity: dealing goods - Opening hours: from 5h00 till 18h00 every day - A hustling market of the ward. People live on both sides of the route. Environment is clean.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access by dealers and local people - Traffic accident risk - Conflict with workers. - Living and trading activities of local people.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works.
12	Kim Dong Primary School 	- In group 31, Minh Tan ward, 5m from the construction site in the back - Opening time: weekdays - Total 1,000 pupils and 50 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at school - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the

No	Sensitive areas	Description	Impacts	Mitigating measures
				day. - Use pre-cast box culverts and finish the construction works within a working day.
13	Hoa Hong Kindergarten 	- In group 50, Minh Tan ward, 5m from the construction site. - About 300 kids and 25 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at school - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.
14	Residential area 	- The shortest distance is 10-200m from L89 to L92 piles.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary

No	Sensitive areas	Description	Impacts	Mitigating measures
			- Activities of local people	longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.
	Road no. 3 – from Nguyen Tat Thanh intersection to Au Co intersection (5 sensitive areas and residential area)			
15	Nguyen Tat Thanh High School 	- In Luong Thinh 2 hamlet, Tan Thinh ward, about 30-100m from the construction site - About 800 pupils and 34 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at the school - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly

No	Sensitive areas	Description	Impacts	Mitigating measures
				after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.
16	Nguyen Hue High School 	- In Luong Thinh 2 hamlet, Tan Thinh ward - About 300 pupils and 25 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers. - Picking up children at the school - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day.
17	Tan Thinh church 	- Thanh Hung 1 hamlet, Tan Thinh ward, about 50m from the construction site. - Number of visitors: 200/630 parishioners - Opening hours: 19h00 at weekdays; 8h00 and 19h30 at weekend	- Dust, emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Not to place construction materials and waste materials within a range of 20m from the church. - Water the site to prevent dust twice/day in front of the church. - Clear wast materials after

No	Sensitive areas	Description	Impacts	Mitigating measures
			- Religious activities of the community	each working day. - Refrain from carrying out the works during service time (weekday evenings, weekend afternoons).
18	Nguyen Trai Primary School 	- In Luong Thinh 2 hamlet. Tan Thinh ward - About 300 pupils and 25 teachers - Working hours: 6h30 – 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at the schools - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.
19	Tan Thinh commune medical station 	- In Thanh Hung 3 hamlet, Tan Thinh ward, about 400m from the construction site - Located on the construction road, sparsely populated, 2.5-3m earth road. - Number of visitors: about 30 persons/ month,	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the

No	Sensitive areas	Description	Impacts	Mitigating measures
		- Working hours: office hours and 24/7 on duty.	- Medical examination and treatment	house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night.
20	Residential area 	- Residential area (85, 66A, 49, ND9, A42, A43, 80, 88, 76 piles), about 30 – 100m from the construction site	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.
	Road No.2 – connecting Bach Lam bridge to Van Phu bridge			
21	Vocational College 	- Located on inter-communal road, about 400m from the construction site. - Sparse population. - About 500 students	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to

No	Sensitive areas	Description	Impacts	Mitigating measures
		- Office hours: 24/5. Weekend off.	- Traffic accident risk - Conflict with workers. - Activities, teaching and learning of students and teachers - Extra-curricular activities	5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.
22	Van Phu hamlet communal house 	- In Van Phu hamlet, about 1km from the construction site - Number of attendants: 60 people - Frequency: once a week in the evening. - Sparse population, vegetation includes mainly brushwood, small trees	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works.
23	Van Phu Primary and Secondary School 	- Located on the construction road, at 2A pile near intersection at Km4. - About 1080 students. - Sparse population, vegetation includes mainly brushwood,	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading

No	Sensitive areas	Description	Impacts	Mitigating measures
		small trees; no drainage system. - Opening hours: from 6h30 - 7h30, 11h-12h, 13h-14h and 16h30-17h30.	- Conflict with workers. - Activities, teaching and learning of pupils and teachers. - Picking up children at the school - Extra-curricular activities	materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.
24	Tuy Loc hamlet communal house 	- In Tuy Loc hamlet, about 70m from the construction site; - Sparse population, vegetation includes mainly brushwood, small trees. - 50 people - One night every week.	- Dust, emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works.
25	Van Phu temple and pagoda 	- In Tuy Loc hamlet, sparse population, mainly brushwood, small trees along the route; - Number of attendants: 50 people - Frequency: annual Buddhist ceremonies such as Buddha's birthday, ghost	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers.	- Notify the church management board and the community of the construction schedule at least 2 weeks before starting works. - Not to place construction materials and waste materials within a range of 20m from the church. - Water the site to prevent

No	Sensitive areas	Description	Impacts	Mitigating measures
		festival, quiet-seeking rituals, etc.	- Religious activities of local people and visitors	dust twice/day in front of the church. - Clear waste materials after each working day. - Refrain from carrying out the works during service time (weekday evenings, weekend afternoons).
26	Residential area 	- Residential area (Km 0-Km 0+400 at TD1, TC2), about 10 – 20m from the construction site - Residential area at Km 3-4 (piles 29, 30, 33, 34), about 30-100m from the construction site. - Residential area at Km 4 – Km 5 (2A, TC4, TC5, 24-28, 35-39 piles), about 10 – 50m from the construction site.	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.
	Road no.1 – from Dien Bien road to connection road between Bach Lam and Van Phu bridges			
27	Residential area	- Residential area (at TD1, TD3, TD6 piles), about 0 - 20m from the construction site	- Dust, gas emissions - Noise, vibration - Wastewater - Waste	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan

No	Sensitive areas	Description	Impacts	Mitigating measures
			- Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.

5.4. MITIGATION MEASURES IN THE OPERATION PHASE

Mitigation measures for specific impacts in the operation phase are as follows:

(i) Air, dust pollution, noise, vibration

- Clean road surface on Hao Gia, Khe Dai streams, Nam Cuong lakes and roads no.1, 2, 3;
- Collect scattered soil and stone;
- Water the roads by specialised equipment in accordance with the City's general plan;
- Erect the signposts limiting horns (air horn) when passing areas sensitive to noise and vibration (especially in sections near schools, medical stations, pagodas, temples and churches as identified hereinabove);
- Plant trees in the sections crossing residential areas to beautify the landscape and reduce dust and noise in the embankment areas and roads no.1, 2, 3.
- Conduct regular maintenance of road pavement and greenery strips.
- Upgrade the pavement; spread anti-noise asphalt, reduce slope in these sections to reduce noise when speeding up or slowing down.

(ii) Wastewater

- Regularly check drainage culverts and ditches along Nam Cuong lake, Hao Gia stream and Khe Dai stream embankment, drainage culverts along road no.1 – from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge, road no.2 - road connecting Bach Lam bridge to Van Phu bridge and road no.3 – road connecting from Nguyen Tat Thanh intersection and Au Co intersection.
- Regularly collect solid waste on Nam Cuong lake, Hao Gia stream, Khe Dai stream roads and roads no.1, 2, 3 by mechanical/manual methods to prevent them from drifting along with rainwater into the drainage system.

(iii) Waste

- Regularly check drainage culverts and ditches along the embankments, roads and resettlement sites;
- Engage a firm for periodic collection of waste;
- Propagandise and prohibit local people, especially commercial services on the embankments, from littering the embankments;
- Arrange boards guiding the operation of the embankments, roads and resettlement sites;

Mitigation measures for specific impacts are as follows:

(i) Flow and terrain change:

- Closely watch weather developments
- Strictly adhere to the operating rules of the embankments and roads
- Research and monitor subsidence and breakdown (if any) for timely response.
- Inform the managing agency and relevant authorities as soon as possible.

(ii) Transport

- Make available signposts and traffic signs on the embankments and roads when they come into operation;
- Organise traffic flows, boundary marks and road marks, etc.
- Disseminate traffic rules on the roads;
- Make public the images of traffic accidents in certain information disclosure points to deter people.

(iii) Land use purpose change

- Execute the compensation and subsidy plans as approved
- Record the community's feedbacks for appropriate adjustments
- Provide concrete guidelines as to land use purpose change, compliance with local land use planning and land use planning.
- Publicize the planning and regulations on urban construction for the community.
- Reform of administrative procedures in the field of registration and issuance of certificates: Continue to simplify the composition of the file, reduce the time to carry out administrative procedures; improve administrative discipline and improve service quality to meet the satisfaction of people and enterprises.
- Resolve quickly and appropriately the contradictions caused by conversion of land use purpose.
- To intensify the examination, inspection and handling of land violations by organizations assigned or leased land by the State, not allowing repeated and uninterrupted violations. Overcoming the situation of encroachment, occupied land, especially agricultural land, public land is not the right purpose.
- Review all cases of public land, public agricultural land in wards and seriously deal with violations.
- Settlement of land complaints and denunciations in localities should be handled and dealt with in a comprehensive manner, avoiding many protracted cases and excessive

letters that affect the security, politics and order. society.
- To coordinate and closely coordinate the work of inspection, examination and handling of land violations.
- Propagate to raise awareness of people in exercising the rights and obligations of land users and financial obligations on land, land policies and policies
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5.5. MITIGATION MEASURES FOR RISKS AND INCIDENTS

5.5.1. Risks and incidents in the construction phase

- Response to labour accidents:
    - Observe current regulations of work safety
    - Train staff on work safety and require compliance with working rules on the worksite
    - Provide sufficient protective equipment
    - Check and remind staff and workers on a daily basis
    - Pay due attention to health care and have medical staff on the site at all times
    - Provide lighting on worksite at night.
- Traffic accidents:
    - Vehicles only operate with the allowed load and speed
    - Set up signposts on the worksite
    - First aid victim and rush him/her to the nearest hospital or medical ceter.
    - Fuel and chemical spill, fire, explosion, electric shock
    - Strictly ban smoking and flammable materials in warehouses
    - Make available portable fire extinguishers;
    - Design and install the electricity system with sufficient safety equipment such as fire-resistant materials, automatic circuit breaker, etc.
    - Design and make available the facilities in compliance with safety regulations on fire control, install fire prevention systems and must be certified by the competent authorities of fire safety.
    - Regularly propagandise about the fire prevention regulations. Provide regular training and practice for staff;
    - Train on first-aid skills;
    - Inform the authorities and Project Owner as soon as possible of the incident, if any
- Uncovering archaeological and historical relics and tombs
    - Stop the construction immediately;
    - Inform the Project Owner and relevant agencies;
    - Protect the scene until the authorities come.
- Other incidents
    - Ensure saniation and food hygiene for workers in site capms;
    - Ensure minimum living conditions and hygiene at worksite and camps;
    - Tidy up and clean regularly
    - Spray mosquitocidal and other pest control methods on a regular basis;
    - Train workers on first-aid skills before moving victim to the nearest hospital or medical center;

5.5.2. Risks and incidents in the operation phase

- Embankment erosion, bridge breakdown, road subsidence
    - Local governments need to take steps to improve people's awareness of environmental protection
    - Conduct periodic remodelling of the roads. Remedy any damage to road surface, slopes and embankments
    - Erect signposts guiding loads and types of vehicles permitted to use the bridges, roads and embankments in notable positions.
    - Regularly check quality of bridges and embankments to avoid possible incidents
- Falling into streams and lakes, drowning in sewers
    - Local governments need to take steps to improve people's awareness of environmental protection
    - Propagandise and prohibit local people, especially commercial services on the embankments, from littering the embankments.
    - Arrange waste bins along the emabankments;
    - Arrange signposts guiding people to travel safely
    - Arrange guardrails or door with height of 80-90cm at the operation and management stairs to the walkway on the embankment, including danger indicator and light.
    - Check and repair promptly the damaged embankment sections as heavy rain will cause serious erosion and collapse.
    - Design, layout areas of grass landslides of the three lines 1, 2 and 3 respectively about 8 958m^2, 44 717m^2 and 64 366m^2 of grass; and planting such as lobster, canaries, black stars... with a diameter of 10-12cm, height 4m, estimated trees about 260, 820 and 830 trees per route.
    - Planting trees (canary, canary, black star with a diameter of 10-12cm, height of 4m, planted along Nam Cuong, Hao Gia and Khe Dai streams, resettlement area with an estimated number of 950 780, 800 and 360 trees.


Figure 57: Embankment and road covered with trees and grass

- Road and railway traffic accidents
    - Local government needs to disseminate to the community the identification of signages
    - Inform regularly and periodically the operation schedule of the railway running near the residential areas
    - Arrange large size signposts and guiding boards
    - Arrange staff to guide users in the beginning of the operation period
    - First aid and bring victim to the nearest clinic and inform the local authorities of the accident.

CHAPTER 6. ENVIRONMENTAL - SOCIAL MANAGEMENT PLAN

On the basis of the assessment of negative impacts presented in Chapter 4 and the impact mitigating measures recommended in Chapter 5, this Chapter will present the Environmental and Social Management Plan (ESMP) for Yen Bai city Subproject. The Environmental Management Program will identify the activities/actions to be implemented in the Yen Bai city Subproject, including the environmental monitoring program and its implementation schedule, taking into account the compliance with the provisions of the Government's ESIA and safety policies of the World Bank (WB).

To ensure that all sources of pollution arising from the subproject activities during the preparation stage and the construction stage as well as in the operation period will not cause any negative impacts on the environment and public health, it is compulsory that the management, monitoring and supervision of environmental quality be executed in a scientific, systematic and regular manner. Below is a summary of environmental impacts, mitigating measures and responsibilities of stakeholders.

6.1. MITIGATION MEASURES FOR CONSTRUCTION PHASE

ESMP's mitigating measures for construction phase are divided into 3 basic parts: (1) ECOPs, (2) Specific mitigation measures for the specific types of works, and (3) Site-specific mitigation measures for each sensitive location to be affected by the subproject's works items.

(1) All of the potential negative impacts on physical, biological, and social environment could be mitigated through a set of general measures that are typically applied to most of construction subprojects to minimize impacts such as noise, dust, vibration, waste generation, traffic hindrance, public safety, etc. In this context, an ECOPs has been prepared describing specific requirements to be carried out by contractor to mitigate the subproject potential impacts considered to be general impacts (Section 6.1). The contractor will also be required to mitigate site-specific impacts which will be identified to address issues specific to the subproject.

(2) In addtion to adopting the ECOPS, specific mitigation measures have been identified (Section 6.2) for addressing the impacts associated with the specific types of works under the subproject such as sewers, drainage systems. These measures will be included in the contracts for corresponding packages.

(3) All the specific impacts for each sensitive receptor of which mitigation measures could not be addressed through implementation of the ECOPs, site-specific mitigating measures will need to be implemented (Section 6.3).

Measures to mitigate impacts from land acquisition and resettlement are mentioned separately in the Resettlement Plan (RP) and those measures will be carried out and supervised separately.

6.1.1. Mitigation measures for generic impacts

Typical common impacts which will be minimized by mitigation measures defined in ECOP include: (1) Dust, exhaust gases, noise and vibration; (2) wastewater management; (3) Solid waste management; (4) Hazardous waste; (5) Water pollution management; (6) Impacts on aquatic species and terrestrial ecology; (7) Management of impacts on urban landscape and beauty; (8) Management measures of sedimentation, erosion and flooding; (9) Traffic safety management; (10) Influence to existing infrastructure and services, (11) Management of impacts on social activities; (12) Management of impacts on cultural and religious works; (13) Measures to secure community healthand safety; (14) Measures to secure worker's health and safety, (15) Management of warehouses and borrow pits, (16) Communication to local community.

Table 44: Environmental Codes of Practices for addressing generic construction impacts (ECOPs)

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by

1) Generated dust, emission, noise, vibration	- 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. - Vehicles in Vietnam must undergo a regular emissions check and obtain certification: "Certificate of conformity from inspection of quality, technical safety and environmental protection" following Decision No. 35/2005/QD-BGTVT - 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 25oC, or in windy weather. Avoid overwatering as this may make the surrounding muddy. - Exposed soil and material stockpiles shall be protected against wind erosion and the location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors. - Dust masks should be used by workers where dust levels are excessive - There should be no burning of waste or construction materials on site. - Cement processing plants should be far from residential areas. - 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. - 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 20m3within 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. - Do not put vehicles and machines to run idle in more than 5 minutes. - Avoid preparations 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. - 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	- QCVN **05: 2013/MONRE**:*National technical regulation on ambient air quality* - **QCVN 26:2010/BTNMT:** National technical regulation on noise - **QCVN 27:2010/BTNMT:** National technical regulation on vibration - **TCVN 6438-2005:** Road vehicles. Maximum permitted emission limits of exhaust gas - Decision No. 35/2005/QD-BGTVT on inspection of quality, technical safety and environmental protection;	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	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. - When needed, measures to reduce noise to acceptable levels must be implemented and could include silencers, mufflers, acoustically dampened panels or placement of noisy machines in acoustically protected areas - Avoiding or minimizing transportation through community areas and avoiding as well as material processing areas (such as cement mixing).			
2) Wastewater management	- The Contractor must be responsible for compliance with Vietnamese legislation relevant to wastewater discharges into watercourses. - Employ local workers to limit the amount of generated domestic wastes and wastewater. - Provide septic tanks for toilets for treating wastewater before it can be discharged into the environment. On-site mobile toilets with 3-compartment septic tanks can be used in areas for major work items as traffic roads. Wastewater from toilets as well as kitchens, showers, sinks, etc. shall be discharged into a conservancy tank for removal from the site or discharged into municipal sewerage systems; there should be no direct discharges to any waterbody - Wastewater containing pollutants over standards set by relevant Vietnamese technical standards/regulations must be collected in a conservancy tank and removed from site by licensed waste collectors. - Clear ditches around the workers' camps every week. - Build sedimentation ponds and ditches to receive stormwater runoff at the construction sites such as the areas for Lam Ha 1 Lake, stormwater and wastewater pumping stations. - Make appropriate arrangements for collecting, diverting or intercepting wastewater from households to ensure minimal discharge or local clogging and flooding. - Before construction, all necessary wastewater disposal permits/licenses and/or wastewater disposal contracts have been obtained. - At completion of construction works, wastewater collection tanks and septic tanks shall be safely disposed or effectively sealed off	- QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater; - QCVN 40: 2011/ BTNMT: National technical regulationon industrial wastewater	Contractor	PMU, CSC, IEMC

3) Solid waste and dredged sludge management	- Before construction, a solid waste control procedure (storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.) must be prepared by the Contractors and it must be carefully followed during construction activities. - Before construction, all necessary waste disposal permits or licenses must be obtained. - Solid waste may be temporarily stored on site in a designated area approved by the Construction Supervision Consultant and relevant local authorities prior to collection and disposal through a licensed waste collector. - Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. - No burning, on-site burying or dumping of solid waste shall occur. - If not removed off site, solid waste or construction debris shall be disposed of only at sites identified and approved by the Construction Supervision Consultant and included in the solid waste plan. Under no circumstances shall the contractor dispose of any material in environmentally sensitive areas, such as in areas of natural habitat or in watercourses. - Limit waste pollution from litter and drop of materials. Place dustbins at the workers' camps. - Temporarily collect and separate domestic wastes. Provide watertight dustbins for domestic waste and tightly cover them to avoid giving rise to bad odors and leachate leakage, attracting flies, mice and other pathogenic species. Periodically collect and transport the waste to the disposed site. - Perform concrete mixing on impermeable ground. Collect waste and wastewater containing cement through drainage ditches with sedimentation pits in construction sites before being discharged into receiving waters. - Separate the components and parts which can be reused or recycled in the construction wastes before transporting the waste to disposed site in accordance with design documents acceptable to the supervision engineer. - Weathered soil, wood and bricks can be reused for useful purposes such as ground leveling. Wood scraps may be used for cooking. Corrugated iron, iron, steel, packing materials and other materials which can be recycled can be delivered and sold to scrap traders. - Collect waste and tidy up construction sites at the end of a working day/shift and the transport waste out of the construction sites in the soonest possible time. If dredged materials are to be temporarily stored, necessary measures must be applied to control pollution such as gathering them within enclosures, under coverings, within fenced areas, etc. with warning signs. - Dredge (from lakes, streams) must be collected, transported, dumped, reused,	- Decision No, 59/2007/NĐ-CP on garbage management; - Decision No, 38/2015/NĐ-CP dated 24/04/2015 on waste and scrap management	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	recycled and handled in accordance with the law. - The Minister of Agriculture and Rural Development shall regulate the management of dredged dredging from streams and irrigation works. - The Minister of Natural Resources and Environment shall regulate the management of dredged sludge from the lake. - Provincial-level People's Committees shall stipulate places for dumping and treatment of dredged sludge. - The Contractor will sign a contract with URENCO to collect solid waste, conforming to 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.			

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
4) Hazardous waste management	- Temporarily collect, store, and transported for treatment all hazardous wastes (road asphalt, waste oil and grease, organic solvents, chemicals, oil paints, etc.) in accordance with Circular No. 36/2015/TT-BTNMT on management of hazardous waste. - Collect and temporarily store used oil and grease separately in specialized containers and place in safe and fire-free areas with impermeable floors roofs, at a safe distance from fire sources. Sign contracts with for oil and grease to be delivered to suppliers/ manufacturers - Chemical waste of any kind shall be disposed of at an approved appropriate landfill site and in accordance with local legislative requirements. The Contractor shall obtain needed disposal certificates. - The removal of asbestos-containing materials or other toxic substances shall be performed and disposed of by specially trained and certified workers. - Used oil and grease shall be removed from site and sold to an approved used oil recycling company. - Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and removed from site by a specialized oil recycling company for disposal at an approved hazardous waste site. - Used oil or oil-contaminated materials that could potentially contain PCBs shall be securely stored to avoid any leakage or affecting workers. - Unused or rejected tar or bituminous products shall be returned to the supplier's production plant. - Relevant agencies shall be promptly informed of any accidental spill or incident - Store chemicals appropriately and with appropriate labeling - Appropriate communication and training programs should be put in place to prepare workers to recognize and respond to workplace chemical hazards - Prepare and initiate a remedial action following any spill or incident. In this case, the contractor shall provide a report explaining the reasons for the spill or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions.	- Circular No. 36/2015/TT-BTNMT on hazardous waste management; - Decision No. 38/2015/NĐ-CP dated 24/04/2015 on waste and scrap management	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
5) 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. - Provide preliminary sedimentation ponds and ditches of stormwater runoff at the construction sites such as the areas for roads, regulation lake. - Provide construction workers on site with mobile toilets. - Avoid excavation and backfilling during rains. - Gather materials and wastes generated during excavation and backfilling, collect and transport them out of the construction site to the approved disposal sites within the soonest possible time. - Do not allow temporary gathering of bulk materials and mixing of concrete within 50m from ponds, lakes, rivers, streams, or other water sources. Maintain maximum distances possible between the gathering points to water sources in the construction of Chau Giang river southern embankment. - Store used and unused oil and petrol in closed containers on impermeable ground covered with roofs and contained within surrounding banks for easy control and collection in case of leakage. Do not locate oil and petrol storages within 25m from ponds, lakes, rivers, and streams. - Collect and transport excavated soils from the construction of sewers and ditches out of the construction site within 24 hours. - Only perform maintenance work of motored vehicles and equipment, including oil replacement or lubrication in designated areas, without allowing chemicals, petrol, oil, or grease to leak onto soil or into the drainage system or water sources. Trays are to be used to hold rags and materials used in maintenance. Collect and discard wastes in accordance with hazardous waste management regulation.	- QCVN 09:2008/BTNMT: National technical regulation on underground water; - QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater; - QCVN 40: 2011/ BTNMT: National technical regulationon industrial wastewater; - TCVN 7222: 2002: General requirements for concentrated wastewater treatment plants	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
6) Impacts on plants and aquatic species	- The Contractor shall prepare a Clearance, Re-vegetation and Restoration Management - Plan for prior approval by the Construction Engineer, following relevant regulations. The Clearance Plan shall be approved by the Construction Supervision Consultant and followed strictly by the contractor. Areas to be cleared should be minimized as much as possible. - Limit disturbances to areas with construction operations, especially in locations covered with green trees or vegetation. Do not use chemicals to clear vegetation. - Do not gather materials and wastes at places covered with vegetation or with green trees, but on vacant land instead. - Use sheet pile driving method using Larsen piles to limit impacts on the water quality. - If possible, green trees should be moved and replanted in other places if the trees are in the way of the pipelines to be constructed. - The contractor shall remove topsoil from all areas where topsoil will be impacted by construction activities, including temporary activities such as storage and stockpiling, etc; the stripped topsoil shall be stockpiled in areas agreed to by the Construction Supervision Consultant for later use in re-vegetation and shall be adequately protected. - Trees cannot be cut down unless explicitly authorized in the vegetation clearing plan. - When needed, temporary protective fencing will be erected to efficiently protect the preserved trees before commencement of any works within the site. - No area of potential importance as an ecological resource should be disturbed unless there is prior authorization from CSC, who should consult with PMU, IEMC and the relevant local authorities. This could include areas of breeding or feeding for birds or animals, fish spawning areas, or any area that is protected as a green space. - The Contractor shall ensure that no hunting, trapping, shooting, poisoning of fauna takes place.	- Law on environmental protection No. 55/2014/QH13	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
7) Impacts on urban landscape and beauty	- Carefully cover transport vehicles for materials and waste and periodically wash and clean the vehicles. - 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. - Do not temporarily gather construction materials and wastes within 20m from the gate of schools, offices temples, pagodas, etc. - The Contractor will have to work out 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 works such as pagodas, churches, temples, etc. - Regularly collect materials and wastes and tidy up the construction site. - Materials and waste around the construction site must be regularly collected and construction sites are to be neatly tidied up.	- Law on environmental protection No. 55/2014/QH13 - TCVN 4447:1987: Construction regulation - Circular No. 22/2010/TT-BXD on requirements on safety	Contractor	PMU, CSC, IEMC
8) Sedimentation, erosion, flooding, subsidence and slides	- 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.	- TCVN 4447:1987: Construction regulation - Circular No. 22/2010/TT-BXD: Regulation on construction safety - QCVN 08:2008/BTNMT – National technical regulation on surface water quality	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
9) Traffic management	- Before construction, carry out consultations with local government and community and with traffic police. - Arrange and provide separate passageway with safe and easy access for pedestrian and for people with disability and mobility issues especially the areas in proximity of schools, including easy wheel chair access and hand rail. Make staff available any time for helping people with disability if needed. - Set up traffic and maintain instruction signs and warnings to secure safety for people and means of transport during construction. - Put speed limit signs at a distance of 200m from the construction site. - Carefully cover materials on trucks. Do not load to a height of 10cm higher than the truck body so as not to spill out and scatter materials onto roads, giving rise to dust and endangering road users. Collect spilt soils and materials at the construction site each day to avoid slippery incidents for vehicles. - Do not park vehicles in the roads longer than necessary. Do not allow construction vehicles and materials to encroach upon the pavements. - During construction near schools, deploy staff 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, do not allow flared horns, and do not dispose the waste and wastewater onto areas near schools. - Install night lighting of all construction sites. - Significant increases in number of vehicle trips must be covered in a construction plan previously approved. Routing, especially of heavy vehicles, needs to take into account sensitive sites such as schools, hospitals, and markets. - Installation of lighting at night must be done, if necessary, to ensure safe traffic circulation. - Employ safe traffic control measures, including road/rivers/canal signs and flag persons to warn of dangerous conditions. - Avoid material transportation for construction during rush hours. - Passageways for pedestrians and vehicles within and outside construction areas should be segregated and provide for easy, safe, and appropriate access. Signposts shall be installed appropriately in both water-ways and roads where necessary.	- Law on communication and transport No. 23/2008/QH12; - Law on construction No. 50/2014/QH13; - Law No. 38/2009/QH12 dated 19/6/2009 amending and supplementing some articles of the Law relating to capital construction investment - Circular No. 22/2010/TT-BXD on regulation on construction safety	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
10) Influence to existing infrastructure and services	- Provide information to affected households on working schedules as well as planned disruptions (at least 2 days in advance). - The Contractor must only use vehicles of sizes and loads within permissible limits for the roads along such vehicles' route. - 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. - Stop construction when existing works are damaged. Identify causes of related incidents and work out solutions. In case the damages are due to the Contractors' faults, the Contractors have to repair, recover, and compensate for all damages at their own expenses. The results of handling such damages must be approved by the Supervisor Engineer. - Reinstall the road surface and sidewalks at construction sites after the construction of sewer lines has been completed. - The contractor should ensure alternative water supply to affected residents in the event of disruptions lasting more than one day. - Any damages to existing cable utility systems shall be reported to the authorities and repaired as soon as possible.	- Decree No. 73/2010/ND-CP on administrative penalization of violations related to security and social affairs	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
11) Social mitigation measures through worker management	- Inform the community at least 2 weeks before commencement of the construction. In case electricity and water supplies are to be disrupted, the PMU must inform PAHs of the same at least 2 days in advance. - Employ local laborers for simple tasks. Instruct workers on environmental issues, safety and health before construction tasks are assigned. It is advisable to communicate to migrant workers on local customs, practices and habits in order to avoid conflicts with local people. - The subproject owner and contractor are to cooperate closely with the local government in performing effective community sanitation in case of epidemic symptoms breaking out in the area. - The subproject owner and contractor are to cooperate with local authorities in preventing and fighting against social evils. Conduct sensitization campaigns with both workers and communities on these issues, liaison with local organizations to ensure monitoring, and a grievance redress system to which the community can refer to. - The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers. - Workers temporarily residing at the camps and rented houses must be registered with the local authorities for temporary residence. - Train workers on issues related to social security, social evils, diseases and epidemics, prostitution and drug use, environment, safety and health, HIV/AIDS and infectious diseases within 2 weeks prior to the commencement of packages with construction items lasting at least 6 months. - Prohibit workers from: - Consuming alcoholic drinks during working time - Quarreling and fighting - Gambling and indulging in social evils such as drug use and prostitution - Disposing of garbage indiscriminately	- Decree No. 73/2010/ND-CP on administrative penalization of violations against security and social affairs	Contractor	PMU, CSC, IEMC

12) Control of impacts on cultural works	- Do not gather materials and wastes within 20m from cultural, historical, and religious works such as temples, pagodas, churches, monuments, historic relics, etc. Water spray the construction sites next to such works. - Do not use machines generating loud noise and high vibration levels near cultural, historical, and religious works. - In case of archeological objects being unearthed during the implementation of earthwork, all parties will conform to the following procedures: + In case of archeological objects being unearthed during the implementation of earthwork, all parties will conform to the following procedures: + Suspend construction operations at the place of discovery; + Preliminarily describe the area where the archaeological objects are to be unearthed; + Strictly protect the area of the discovery so as not to damage or lose moveable objects. In case the unearthed objects are moveable or sensitive ruins, provide night protection until the local authorities, the Department of Culture, Sports and Tourism or the Institute of Archaeology takes over these unearthed objects; + Inform the Supervision Engineer of the event and who in turn will immediately inform the subproject owner, the local authorities in charge of the case and the Institute of Archaeology (within 24 hours or less); + Local relevant agencies and the Vietnam National Administration of Tourism will be responsible for protecting and preserving such archaeological relics before making decisions on the next suitable formalities. The Institute of Archaeology may be needed in the preliminarily assessment of the unearthed objects. The significance and importance of such discovered objects will be assessed by different criteria related to the nature of cultural heritages; such criteria would include aesthetic, historical, scientific, social or economic values; + Decisions on handling such discovered objects will be made by competent levels. Such decisions can result in changes in site arrangements (e.g. when the discovered item is a cultural relic which cannot be displaced or is archaeologically important, it is necessary to preserve, recover and excavate it); + The implementation of such decision by competent agencies related to the management of discovered objects will be communicated in writing by local competent agencies; and + Only resume construction activities at the site after being permitted by the local competent agencies and the PMU in relation to safeguarding such relics	- Law on cultural heritage No. 28/2001/QH10; - Amended and supplemented Law on cultural heritage No. 32/2009/QH12; - Amended and supplemented Decree No. 98/2010/ND-CP	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
13) Community's safety and health	- The Contractor will have to conform to regulations in Circular No. 22/2010/TT-BXD by the Ministry of Construction on safety in construction. - The subproject owner and contractor are to cooperate closely with the local government in performing effective community sanitation in case of epidemic symptoms breaking out in the area. - The subproject owner and contractor are to cooperate with local authorities in preventing and fighting against social evils. - Fence of excavation pits and open channels and make off with luminous cordon and warning signs. Provide sufficient lighting when carry out construction at night. - Limit the speed of transport means to 20km/h within 200m from the construction site so as to minimize dust and noise. - Keep noise-generating machines and vehicles at such suitable distances that noise transmitted to residential areas will not be higher than 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.	- Circular No. 22/2010/TT-BXD regulation on construction safety - Directive No. 02/2008/CT-BXD on safety and sanitation issues in construction units - TCVN 5308-91: Technical regulation on construction safety - Decision No. 96/2008/QD-TTg on clearance of UXOs	Contractor	PMU, CSC, IEMC

14) Workers' health safety	- Train workers on issues related to environment, safety and health, thus enhancing their awareness of HIV/AIDS and infectious diseases within 2 weeks prior to the commencement of packages with construction items lasting at least 6 months. - Provide workers with and request them to use adequate safety gear such as masks, helmets, shoes/boots, goggles, etc. depending on job characteristics. - Safely install power lines at offices and in construction sites and do not lay connectors on the ground or water surface. Electric wires must be with plugs. Place outdoor electric panels in protection cabinets. - Limit the speeds of vehicles traveling inside construction sites to be 5km/hour. - Provide fire-extinguishers, first-aid bags, and medical cabinets with sufficient medicines for treating general diseases in the locality must be provided at construction sites. - Safely store fuels and chemicals 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 case of chemical and fuel leakage, the following steps will have to be taken: - Immediate check must be carried out to detect any possible case of injury. In case of injury, first-aid must be given and the injured person must be rushed to the nearest medical station for healthcare, and at the same time the case must be informed to the Supervision Engineer and the PMU; - Carry assessment to determine the kind of leaking/overflowing fuel/chemical; - Do not flush overflowing chemicals into drainage systems. Send staff with suitable safety gear to the site to handle the leakage by scattering sawdust (in case of small volumes of leaks/overflow) or sand (for high volumes of leaks/overflow). Use shovels to remove the surface soil layer if the leakage/overflow takes place on vacant land; and - Subsequent to the occurrence of such incident or accident, the Contractor will have to prepare a detailed report describing the incident and performed activities and submit the same to the Supervision Engineer and the PMU for consideration and filing. Such report will also be presented to the Department of Natural Resources and Environment or functional agencies at their request.. - Set up the camps with sufficient supplies of clean water, power, and sanitation facilities. There must be at least one toilet compartment for every 25 workers, with separate toilets for males and females. Workers' beds must be provided with mosquito nets so as to prevent dengue fever. Temporary tents will be unacceptable. - Clean camps, kitchens, baths, and toilets and sanitize regularly, and keep in	- Decree No. 22/2010/TT-BXD on regulation of construction safety; - Directive No. 02 /2008/CT-BXD on safety and sanitation issues in construction units; - TCVN 5308-91: Technical regulation on safety in construction; - Decision No. 96/2008/QD-TTg on clearance of UXOs.	Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	good sanitation conditions. Provide dustbins and collect wastes daily from the camps. Clear drainage ditches around the camps periodically. - Stop all construction activities during rains and storms, or upon accidents or serious incidents.			
15) Management of warehouses and borrow pits	- All borrow pit locations to be used must be previously identified in conformity with approved construction technical specifications. Sensitive sites such as scenic spots, areas of natural habitat, areas near sensitive receiving waters, or areas near water sources should be avoided. An open ditch shall be built around the stockpile site to intercept wastewater. - Retaining walls are to set uparound disposal areas if necessary. - The use of new sites for stockpiling, gathering or exploiting materials necessary for construction operations must obtain prior approval from the Construction Engineer. - In case landowners are affected by the use of their areas for stockpiling, gathering or exploiting materials, such landowners must be included in the project resettlement plan. - If access roads are needed for these new sites, they must be considered in the environmental assessment report. - PMU's Environment Officer should conduct due diligence to make sure that borrow pits and quarries are legally operating by undertaking a rapid review of quarry sites to assess if operations are in compliance with Vietnamese laws and Bank requirements prior to construction. - Include the requirement that the contractors shall be required to buy materials from licensed borrow pit and quarry operators into the civil work contractual documents.		Contractor	PMU, CSC, IEMC

Environmental-social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
16) Communication to local community	- Open communications channels are to be maintained with the local government and concerned communities; the contractor shall coordinate with local authorities (leaders of local wards or communes, leaders of hamlets) for agreed schedules of construction operations in areas nearby sensitive places or during sensitive times (e.g. religious festival days). - Copies of Vietnamese versions of these ECOPs and of other relevant environmental protection documents shall be made available to local communities and to workers at the site. - Subproject information will be disseminated to affected parties (e.g. local authorities, enterprises and affected households, etc.) through community meetings before construction commencement. - A contact address will be provided to the community. - The community will be provided with all information, especially technical findings, in a language that is understandable to the general public and in a form convenient to interested citizens and elected officials through the preparation of fact sheets and news releases, when major findings become available during subproject phase. - Community concerns and requested information are to be monitored as the subproject progresses. - Inquiries must be responded by telephone and written correspondence in a timely and accurate manner. - Local residents must be informed about construction and work schedules, interruption of services, traffic detour routes and provisional bus routes, blasting and demolition operations, as appropriate. - Technical documents and drawings will be provided to local People's Committees, especially the sketch of construction areas and the EMP of the construction site. - Notification boards shall be erected at all construction sites providing information about the subproject, as well as contact information about the site managers, environmental staff, health and safety staff, telephone numbers and other contact information so that affected people could have a channel to voice their concerns and suggestions.	- Decree No. 73/2010/ND-CP on administrative penalization of violations related to security and social affairs	Contractor	PMU, CSC, IEMC

6.1.2. Mitigation measures for site - specific impacts

Major specific mitigation measures in this area include: (i) dredging of reservoir No. 1, (ii) ability of landslide, subsidence, sedimentation of streams, reservoir beds (iii) relocation of power poles, (iv) Impacts caused by construction near the railway, (v) Impacts on production forests, (vi) Traffic disruptions, (vii) Difficulties in construction and housing, (viii) Local inundation Specific mitigation measures for the specific ty types of 13 works are show as following:

Table 45: Mitigation measures for site- specific impacts

Site-specific impacts	Specific mitigation measures	Vietnamese regulation	Responsibility	Super-vised by
- Impact on the eco-system from dredging lake 1	- Selecting season-based construction time for optimal construction conditions. - Consulting with local people and authorities and the contractor (if any) for proper planning. - Setting up boards guiding the environment and landscape protection.	Biodiversity Law no. 20/2008/QH12 – providing for preservation and development of bio-diversity; rights and duties of entities and individuals in preservation and development of bio-diversity	Contractor	PMU, CSC
- Embankment erosion and subsidence, lake and stream bed sedimentation	- Arrange appropriate construction site along the embankment route, near the temporary road connecting to the road to foundation pit. - Arrange pile and stop plank fabricating and gathering yards and mixing machines in such a way as to facilitate the supply and transportation of materials to the worksites. - Arrange soil storage yards along the embankment routes to reduce the transportation distance and to ensure smooth traffic and sites for adjacent work items. - Select appropriate construction methods such as arrangement of machines to drive bamboo piles in the embankment sections next to residential areas to avoid affecting public works and houses of local people; - Arrange rainwater drainage and solid waste settlement facilities on the construction sites to reduce solid waste settlement; conduct regular dredging and monitoring, especially in cases of rain and flood. - Prepare concrete construction plan and make public the work schedule; works should be carried out in dry season. - Closely watch weather forecast to carry out the works as per the plan	**TCVN 4447:2012** Earth works - Construction, check and acceptance **Cicular 121/2013/ND-CP** providing for administrative penalties in construction of the works	Contractor	PMU, CSC

Site-specific impacts	Specific mitigation measures	Vietnamese regulation	Responsibility	Super-vised by
	and to the required quality.			
- Impact from displacement of electric poles	- Designate technical staff to instruct the removal of electric poles - Personnel in charge must be qualified in professional skills as required by the works, be trained and granted with electric safety certificate. - Communicate information and exchange personnel and technical skills with the local power supply agency for co-ordination. - As for electricity grid, structures of electricity grids must be dismantled and recovered and site be reinstated within 6 months from the separation of the electricity grid from the electricity system. - Remove and erect electric poles in accordance with the plan so that people are assured of their safety. - The owners of the works must make plan for management and dismantling of the power works no longer in use.	**Electricity Law 2004** **Resolution no. 14/2014/ND-CP** providing for the execution of Electricity Law **Cicular 31/2014/TT-BTC** providing in details for electric safety **Decision no. 12/2008/QD-BCT** on National technical standards for electric safety	Contractor	PMU, CSC
- Impact from construction near railway	- Slow down when executing the works or transporting materials to allow time for observation and give signals; - When a train is coming or going to come, stop at 5m away from the rails as a train travelling at a very high speed may take anyone nearby with it; - Observe in both 2 directions and identify the utmost safety position; when a red/yellow light is on or horn is sounded, stop and wait for the train to pass by. - If crossing the rails, speed up to rush to the other side of the road. - If the engine breaks down when crossing the raila and gets stuck there, if no train is coming, ask passers by, police of railway officers for help. - If a train is coming, get off the vehicle immediately without wasting time taking anything in the vehicle and run away from the rails in the opposite direction with the train to avoid objects and debris that may cause injury.	**Railway Law 2017** **Resolution no. 16/2016/ TT-BGTVT** providing for evaluation and certification of system safety with respect to urban railway **Circular no. 37/2014/ TT-BGTVT** on protection of railway works and safety corridor for urban railway **Decree no. 39/CP** on railway security and safety	Contractor	PMU, CSC
- Impact on the production forest land	- Specific measures are presented in the Resettlement Plan;	**Law on forest protection and**	Contractor	PMU, CSC

Site-specific impacts	Specific mitigation measures	Vietnamese regulation	Responsibility	Super-vised by
	- To ensure that the compensation, subsidies and resettlement support rates are compliant with the donor's policies and the laws of Vietnam; - Support the HHs to stabilise their livelihood and production through training courses and occupation change if HH members are in the working ages. - Firing, smoking or other fire hazards are strictly prohibited within the construction site and the dominant forest production area; - Adhere strictly to this collection, used for the project. - Ensure the adequacy of land use allocations for the management, conservation, and sustainable development of forests. - Propagate people in forest protection and development.	**development no. 29/2004/QH11 Law on forest protection and development** (revised), 2017		
- Impact from traffic disturbance	- Make detailed construction plans and make them public 2 weeks before the construction; - Completely finish a work item on the worksite before starting work on others; - Arrange signposts and staff guiding traffic flows (if necessary); - Refrain from transporting and unloading construction materials and waste materials on the main routes in rush hours; - Regulate the vehicles to and from the work sites and appropriate construction quantities.	Law on communication and transport **No. 23/2008/ QH12**; Law **No. 38/2009/ QH12 dated 19/6/2009** amending and supplementing some articles of the Law relating to capital construction investment.	Contractor	PMU, CSC
- Elevation discrepancy between the works and local people's house	- Study the existing terrain when surveying for detailed design preparation and select suitable technical option - Consult with local people and authorities in dealing with elevation discrepancy prior to carrying out the works. - Design the connection from the designed works to local people's houses to ensure entrance to house/works - Support HHs with lower elevation than the design elevation to provide connection and reduce elevation differences.	**Regulation no. 01-2008** of Ministry of Construction on construction planning	Contractor	PMU, CSC
- Impact from local flooding	- Arrange temporary settling holes and rainwater drainage system on the construction site; - Arrange pumps with suitable capacity to pump water when necessary and to prevent inundation of materals and equipment; - Prepare plans for dealing with flooding on the worksite;	**TCVN 4447:2012**: Construction regulation Circular **No. 22/ 2010/TT-BXD**:	Contractor	PMU, CSC

Site-specific impacts	Specific mitigation measures	Vietnamese regulation	Responsibility	Super-vised by
	- Closely watch the weather to prepare appropriate construction methods.	Regulation on construction safety **QCVN 08-MT: 2015/ BTNMT** – National technical regulation on surface water quality		

6.1.3. Mitigation measures for impacts on sensititive receptors

Mitigation measures for sensitive points are shown in the following table:

Table 46: Mitigation measures for sensitive areas

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
	Nam Cuong lakes 1,2,3 embankment (7 sensitive areas and residential area)				
1.	Multi-purpose communal house 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Restricted access to the communal center - Traffic accidents risk - Activities of the local people - Conflict with workers	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.	- Contractor	- Project Owner, CSC, IESC
2.	Medical station	- Dust, gas emissions - Noise, vibration - Wastewater - Waste	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
		- Limited access to emergency medical services - Traffic accident risk - Conflict with workers - Medical examination and treatment activities	traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.		
3.	Communal house of Cau Den hamlet 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access to meetings cultural activities - Traffic accident risk - Conflict with workers.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.	- Contractor	- Project Owner, CSC, IESC
4.	Nam Cuong Primary School 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Classes of pupils - Picking up children at the school - Limited access	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
		- Traffic accident risk - Conflict with workers	the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.		
5.	Son Ca Kindergarten 	- Dust, gas emissions - Noise, vibration - Wastewater - Solid waste - Teaching and learning activities - Limited access - Traffic accident risk - Conflict with workers	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rudh hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.	- Contractor	- Project Owner, CSC, IESC
6.	Martyr's cemetery 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works.	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
		- Visits and ceremonies	- Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.		
7.	Mau Temple, Van Thang pagoda and temple 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Festival activities and holidays in the year.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Build temporary bridge before starting works - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night. - Arrange staff to guide drivers of crane, truck and boring machines to avoid collision with the existing electric wires. - Provide labours with protective equipment, life jacket and safety harness.	- Contractor	- Project Owner, CSC, IESC
8.	Nam Cuong residential area 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Living and production activities of people.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day.	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
			- Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.		
	Hao Gia stream embankment (no sensitieve area except residential area)				
9.	Hao Gia stream residential area 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers - Living, business and production activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.	- Contractor	- Project Owner, CSC, IESC
	Khe Dai stream embankment (4 sensitive areas and residential area)				
10.	Yen Ninh ward medical station 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access to medical services and emergency treatment - Traffic accident risk	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night.	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
		- Conflict with workers - Activities of patients, nurses, doctors			
11.	Minh Tan ward market 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access by dealers and local people - Traffic accident risk - Conflict with workers. - Living and trading activities of local people.	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works.	- Contractor	- Project Owner, CSC, IESC
12.	Kim Dong Primary School 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at school - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.	- Contractor	- Project Owner, CSC, IESC
13.	Hoa Hong Kindergarten	- Dust, gas emissions - Noise, vibration	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks	- Contractor	- Project Owner,

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
		- Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at school - Extra-curricular activities	before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.		CSC, IESC
14.	Residential area 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
	Road no. 3 – from Nguyen Tat Thanh intersection to Au Co intersection (5 sensitive areas and residential area)				
15.	Nguyen Tat Thanh High School 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at the school - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.	- Contractor	- Project Owner, CSC, IESC
16.	Nguyen Hue High School 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers. - Picking up children at the school - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day.	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
			- Cover the unfinished holes, ditches and culverts at the end of the day.		
17.	Tan Thinh church 	- Dust, emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Religious activities of the community	- Notify the community of the construction schedule at least 2 weeks before starting works. - Not to place construction materials and waste materials within a range of 20m from the church. - Water the site to prevent dust twice/day in front of the church. - Clear wast materials after each working day. - Refrain from carrying out the works during service time (weekday evenings, weekend afternoons).	- Contractor	- Project Owner, CSC, IESC
18.	Nguyen Trai Primary School 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers - Picking up children at the schools - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.	- Contractor	- Project Owner, CSC, IESC
19.	Tan Thinh commune medical station	- Dust, gas emissions - Noise, vibration - Wastewater - Waste	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites.	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
		- Limited access - Traffic accident risk - Conflict with workers. - Medical examination and treatment	- Coordinate with removing service supplier to remove the house before starting works. - Arrange signposts and lights at two ends of and along the temporary bridge at night.		
20.	Residential area 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.	- Contractor	- Project Owner, CSC, IESC
	- Road No.2 – connecting Bach Lam bridge to Van Phu bridge (5 sensitive areas and residential area)				
21.	Vocational college 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers.	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class.	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
		- Activities, teaching and learning of students and teachers - Extra-curricular activities	- Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day. - Use pre-cast box culverts and finish the construction works within a working day.		
22.	Van Phu hamlet communal house 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works.	- Contractor	- Project Owner, CSC, IESC
23.	Trường THCS, Tiểu học Văn Phú 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities, teaching and learning of pupils and teachers. - Picking up children at the school - Extra-curricular activities	- Notify the community and the School Managing Board of the construction schedule at least 2 weeks before starting works. - Erect works indicators and limit speed up to 5km/h - Refrain from unloading materials and waste during rush hours. - Arrange staff to guide traffic during the working hours and after the class. - Set up danger indicators, fences and lights to separate the construction site with the existing road. - Water the site to prevent dust in dry and windy days at least 3 times a day. - Arrange materials neatly after each working day. - Cover the unfinished holes, ditches and culverts at the end of the day.	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
			- Use pre-cast box culverts and finish the construction works within a working day.		
24.	Tuy Loc hamlet communal house 	- Dust, emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Erect closed guardrails and signposts to organise traffic flows at the outstanding construction sites. - Coordinate with removing service supplier to remove the house before starting works.	- Contractor	- Project Owner, CSC, IESC
25.	Van Phu temple and pagoda 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Religious activities of local people and visitors	- Notify the church management board and the community of the construction schedule at least 2 weeks before starting works. - Not to place construction materials and waste materials within a range of 20m from the church. - Water the site to prevent dust twice/day in front of the church. - Clear waste materials after each working day. - Refrain from carrying out the works during service time (weekday evenings, weekend afternoons).	- Contractor	- Project Owner, CSC, IESC
26.	Residential area 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate	- Contractor	- Project Owner, CSC, IESC

No	Sensitive areas	Impacts	Mitigating measures	Responsibilities	Supervised
			the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.		
	Road no.1 – from Dien Bien road to connection road between Bach Lam and Van Phu bridges (no sensitive area except for the residential area)				
27.	Residential area 	- Dust, gas emissions - Noise, vibration - Wastewater - Waste - Limited access - Traffic accident risk - Conflict with workers. - Activities of local people	- Notify the community of the construction schedule at least 2 weeks before starting works. - Prepare construction plan for carrying out the works in dry season. - Provide temporary entrances when executing culverts that may obstruct entrance to houses. - Build temporary longitudinal drainage canals on two sides of the road. - Periodically clear the drainage ditches and canals. - Clear all waste and materials everyday and not to place them next to the existing road. - Set up danger indicators, fences and lights to separate the construction site with the existing road. Arrange lights at night. - Cover and place danger indicators at unfinished and uncovered holes and ditches. - Water the site during the construction process at least twice/day.	- Contractor	- Project Owner, CSC, IESC

6.2. MITIGATION MEASURES FOR NEGATIVE IMPACTS IN THE OPERATION PHASE

Mitigation measures in the operation phase referred to are (a) generic impacts, and (b) specific impacts

6.2.1. Mitigation measures for general impacts

Mitigation measures for generic impacts are presented in the table below:

Table 47: Mitigation measures for generic impacts in the operation phase

Site-specific impacts	Impacts	Specific mitigation measures	Responsi-bility	Super-vised
- Air and dust pollution - Noise, vibration	- Health of travellers and some HHs nearby - Obstruct and reduce travel sight - Houses and sensitve areas such as market, school, medical station are affected by noise and vibration.	- Clean road surface on Hao Gia, Khe Dai streams, Nam Cuong lakes and roads no.1, 2, 3; - Collect scattered soil and stone; - Water the roads by specialised equipment of the city; - Erect the signposts limiting horns (air horn) when passing areas sensitive to noise and vibration (especially in sections near schools, medical stations, pagodas, temples and churches as identified hereinabove); - Plant trees in the sections crossing residential areas to beautify the landscape and reduce dust and noise in the embankment areas and roads no.1, 2, 3. - Conduct regular maintenance of road pavement and greenery strips. - Upgrade the pavement; spread anti-noise asphalt, reduce slope in these sections to reduce noise when speeding up or slowing down.	PMU/ Other management unit	PMU/ Other management unit
- Wastewater	- Rainwater spills over the sub-project's work items, flowing to the catchments/receptors	- Regularly check drainage culverts and ditches along Nam Cuong lake, Hao Gia stream and Khe Dai stream embankment, drainage culverts along road no.1 – from Dien Bien road to the road connecting Bach Lam bridge to Van Phu bridge, road no.2 - road connecting Bach Lam bridge to Van Phu bridge and road no.3 – road connecting from Nguyen Tat Thanh intersection and Au Co intersection. - Regularly collect solid waste on Nam Cuong lake, Hao Gia stream, Khe Dai stream roads and roads no.1, 2, 3 by mechanical/manual methods to prevent them from drifting along with rainwater into the drainage system.	PMU/ Other management unit	PMU/ Other management unit
- Waste	- People reside along the embankments and roads, travellers and businesses along the routes. - Affect urban aesthetic looks.	- Regularly check drainage culverts and ditches along the embankments, roads and resettlement sites; - Engage a firm for periodic collection of waste; - Propagandise and prohibit local people, especially commercial services on the embankments, from littering the embankments; - Arrange waste bins along the embankments; - Arrange boards guiding the operation of the embankments, roads and resettlement sites.	PMU/ Other management unit	PMU/ Other management unit

6.2.2. Mitigation measures for specific impacts

Mitigation measures for specific impacts are presented in the table below:

Table 48: Mitigation measures for specific impacts in the operation phase

Site-specific impacts	Impacts	Mitigation measures	Responsi-bility	Super-vised
- Impact from flow change 	- Embankment erosion - Embankment and surrounding road subsidence - Affecting people in the surrounding areas and travellers on the embankment.	- Closely watch weather developments - Strictly adhere to the operating rules of the embankments and roads - Research and monitor subsidence and breakdown (if any) for timely response. - Inform the managing agency and relevant authorities as soon as possible.	PMU/ Other management unit	PMU/ Other management unit
- Transport 	- Increased traffic congestions and accidents - Affecting people's health, life, working and learning ability	- Make available signposts and traffic signs on the embankments and roads when they come into operation; - Organise traffic flows, boundary marks and road marks, etc. - Disseminate traffic rules on the roads; - Make public the images of traffic accidents in certain information disclosure points to deter people.	PMU/ Other management unit	PMU/ Other management unit
- Land use purpose change	- Affecting income of people whose land is acquired - Increase value of the existing land and the surrounding land - Giving rise to social conflicts due to increased land price. - Increase traffic volume and attract investment and trade.	- Execute the compensation and subsidy plans as approved - Record the community's feedbacks for appropriate adjustments	PMU/ Other management unit	PMU/ Other management unit

Site-specific impacts	Impacts	Mitigation measures	Responsi-bility	Super-vised
		- Provide concrete guidelines as to land use purpose change - Publicise urban construction plan and regulations to the community - Resolve the conflicts resulting from land use purpose change in a timely and suitable manner.		

6.3. MITIGATION MEASURES FOR RISKS AND INCIDENTS IN THE CONSTRUCTION AND OPERATION PHASES

Mitigation measures risks and incidents in the construction and operation phases are set out below:

Table 49: Environmental protection responsibilities

No	Risks, incidents	Mitigation measures	Responsibility	Supervised
	Construction phase (supplemented to the measures mentioned in ECOPs)			
1.	Response to labour accidents	- Observe current regulations of work safety - Train staff on work safety and require compliance with working rules on the worksite - Provide sufficient protective equipment - Check and remind staff and workers on a daily basis - Pay due attention to health care and have medical staff on the site at all times - Provide lighting on worksite at night.	- Contractor	- Project Owner, CSC, IESC
2.	Traffic accidents	- Vehicles only operate with the allowed load and speed - Set up signposts on the worksite - First aid victim and rush him/her to the nearest hospital or medical ceter.	- Contractor	- Project Owner, CSC, IESC

No	Risks, incidents	Mitigation measures	Responsibility	Supervised
3.	Fuel and chemical spill, fire, explosion, electric shock	- Gather materials in the right places with proper warehouses, labelling and signboards, away from where many vehicles travel - Strictly ban smoking and flammable materials in warehouses - Make available portable fire extinguishers; - Provide regular training and practice for staff; - Train on first-aid skills; - Inform the authorities and Project Owner as soon as possible of the incident, if any	- Contractor	- Project Owner, CSC, IESC
4.	Uncovering archaeological and historical relics and tombs	- Stop the construction immediately; - Inform the Project Owner and relevant agencies; - Protect the scene until the authorities come.	- Contractor	- Project Owner, CSC, IESC
5.	Other incidents	- Ensure saniation and food hygiene for workers in site capms; - Ensure minimum living conditions and hygiene at worksite and camps; - Tidy up and clean regularly - Spray mosquitocidal and other pest control methods on a regular basis; - Train workers on first-aid skills before moving victim to the nearest hospital or medical center	- Contractor	- Project Owner, CSC, IESC
	Operation phase			
6.	Embankment erosion, bridge breakdown, road subsidence	- Local governments need to take steps to improve people's awareness of environmental protection - Conduct periodic remodelling of the roads. Remedy any damage to road surface, slopes and embankments - Erect signposts guiding loads and types of vehicles permitted to use the bridges, roads and embankments in notable positions. - Regularly check quality of bridges and embankments to avoid possible incidents	- Project Owner/O& M entity	- Project Owner/O& M entity

No	Risks, incidents	Mitigation measures	Responsibility	Supervised
7.	Falling into streams and lakes, drowning in sewers	- Local governments need to take steps to improve people's awareness of environmental protection - Propagandise and prohibit local people, especially commercial services on the embankments, from littering the embankments. - Arrange waste bins along the emabankments; - Arrange signposts guiding people to travel safely - Arrange guardrails or door with height of 80-90cm, at the operation and management stairs to the walkway on the embankment, including danger indicator and light. - Check and repair promptly the damaged embankment sections as heavy rain will cause serious erosion and collapse. - Design and layout of the area of grass under the road and planting with lobster, canary, black star with a diameter of 10-12cm, height of 4m of the three routelines 1,2 and 3. - Planting trees (lobster, canary, black star with a diameter of 10-12cm, height of 4m, planted along the embankment of Hao Gia, Khe Dai, Nam Cuong, and resettlement areas.	- Project Owner/O& M entity	- Project Owner/O& M entity
8.	Road and railway traffic accidents	- Local government needs to disseminate to the community the identification of signages - Inform regularly and periodically the operation schedule of the railway running near the residential areas - Arrange large size signposts and guiding boards - Arrange staff to guide users in the beginning of the operation period - First aid and bring victim to the nearest clinic and inform the local authorities of the accident.	- Project Owner/O& M entity	- Project Owner/O& M entity

6.4. IMPLEMENTATION ARRANGEMENT, ROLES AND RESPONSIBILITIES FOR ESMP IMPLEMENTATION

6.4.1. ESMP Implementation arrangement

ESMP during construction requires the involvement of several stakeholders and agencies, each with different roles and responsibilities including Yen Bai PPC, PMU, DONRE (Yen Bai Department of Natural Resources and Environment), the Contractors, the Construction Supervision Consultant (CSC), Independent Environmental Mornitoring Consuntant (IEMC) and local communities.

To ensure effective implementation of the ESMP, the following actions will be carried out during the implementation of the subproject:

During the detailed design and tender documentation making

- During the detailed design of technical specifications and preparation of bidding contract documents for each contract, the technical design consultant will incorporate into these bidding and contractual documents the parts of the ESMP specific to that contract, as well as the specific measures identified in the ESMP.
- In preparing the bidding and contract documents, make an effort to ensure that the contractors are aware of the safeguard obligation and commit to comply.

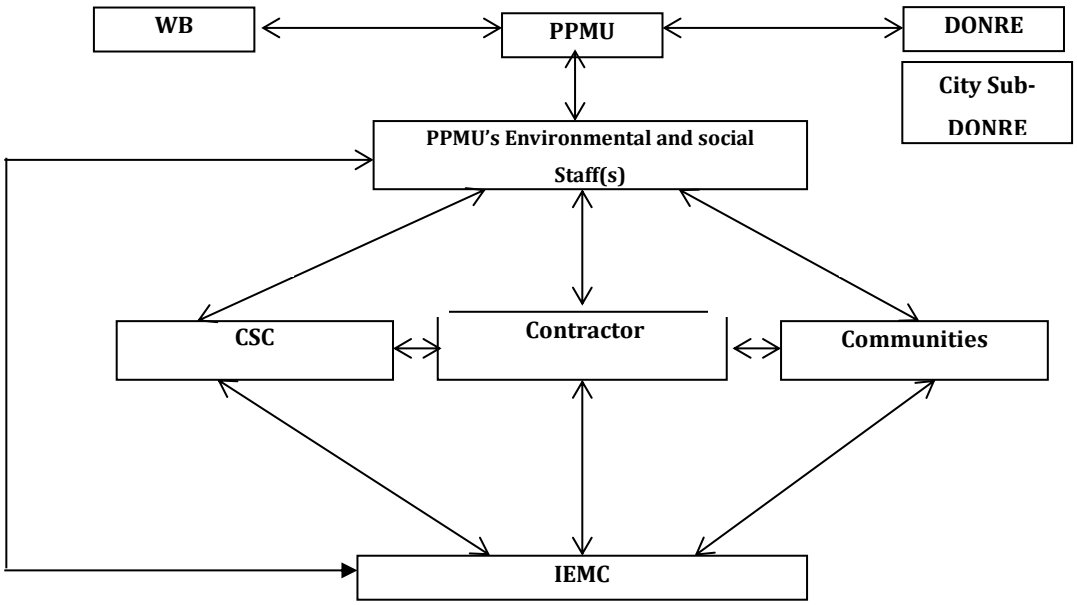


Figure 58: ESMP implementation structure

6.4.2. Environmental protection responsibilities

Roles and responsibilities of the key parties and their relationships regarding the implementation of the ESMP are described as follows:

Table 50: Environmental protection responsibilities

Community/ Agencies	Responsibility
Project Management Unit for Investment and Construction of Yen Bai city – Employer's Representative (PMU)	PMU will be responsible for supervision of the Project implementation, including the compliance with environment regulations. PMU will: - Take responsibility to implement ESMP during the phases of detailed design and construction of the Project. The implementation of ESMP in the operation phase will be implemented by the operation unit. - PMU will establish an Environmental and Social Unit (ESU) to ensure the timely and efficient implementation of ESMP, including preparation of report on compliance with requirements of Vietnamese Government and the Work Bank. - PMU/ESU will be responsible to assure that the relevant components included in the Contracts of packages under the Project are compliant to ESMP. - PMU/ESU will be responsible to connect the relevant stakeholders in planning, supervision, operation and management at the aim of encouraging their participation, including their supervision of the contractors' activities. - In respect of supervision and mornitoring of the contractors' activities, PMU will be responsible for: (a) supervision of environmental compliance; (B) conducting inspection without prior notification; (C) reviewing the periodical reports submitted by the Construction Supervision Consultant (CSC) and (d) based on the periodical reports of CSC and IEMC, preparing environmental report to be submitted to the WB and DONRE.
PMU's Environment Officer (EO):	PMU will nominate a responsible Environment Officer (EO) to solve the Project's environmental problems, supervise the environmental compliance with the safety policies of WB and Vietnamese regulations in different phases of the Project. EO will provide consultancy to the leaders of PMU with measures for environmental problems to ensure the environmental compliance with the safety policies of WB and Vietnamese regulations. EO will coornidate wih CSC group and contractors to check up material mines in the construction phase and decide if they are acceptable to the Porject or not. Social and Resettlement Officer (SRO) of PMU: PMU will nominate at least one SRO responsible for resolving the social and resettlement issues of the Project, monitoring the RPF and RAP compliance, participating in inspection and dealing with the claims related to the social and land acquisition matters
Design Consultant	Incorporate all the environmental impact-mitigating measures into the design documents, cost estimate and civil work contracts as a reference or compulsory term.

Construction Supervision Consultant (CSC)	- Assure the Contractors shall implement the contractual requirements and technical specifications including the requirements of safety and environmental impact mitigation so as to comply with the commitments stated in ESMP reports and Environmental and Social Management Plan (ESMP) approved in the Project. - Conduct periodical supervision of implementing impact-mitigation measures by the contractors, measure and monitor environmental quality once every three-month period and make reports as required by the Project. Upon discovering the excessive pollution against the permitted standards or the contractors' incompliance, CSC will propose and request the contractors to implement additonal mitigation measures. - Organise training for the contractors' workers on environment, working safety and enhancing their awareness of HIV/AIDs. - Propose to PMU for suspending a part or the whole of construction work if the contractor fails to satisfy the requirements of working safety and environment protection as committed or specified in the contract. - Supervise daily environment and make monthly environmental supervision report to be submitted to PMU.
Independent Environmental Mornitoring Consuntant (IEMC)	- Assist PMU within the contractual scope to establish and operate the environmental management system, work out the revised recommendations, enhance capability to the relevant parties during the implementation and supervision of ESMP by the contractors in various phases of the Project. - Take ad-hoc monitoring on the contractors' compliance with environment and safety; - Develop and maintain a claim/complaint registration and implement a mechanism for claim settlement. - Make an independent environmental monitoring report for every six month-period to submit to WB and PMU.
Contractors	- Prepare detailed environmental and social management Plan of the package to be submitted to PMU for its prior review and approval before commencement of the Works. - Obtain full permits in relation to material sources, material mines, waste discharge, control and distribution of traffic, road digging and working safety, etc. - Arrange safety and environment officer at the work site to supervise the workers' compliance. - Implement the mitigation measures as specified in the Contract and commitments of the Project in the approved ESMP and EIA. - Take the remedial actions as required by the Employer and Independent Consultant.
Communities	Take voluntary monitoring in accordance with Decree No. 19/2015/ND-CP Supervise the contractors' negative impact mitigation measures.

6.5. ENVIRONMENTAL COMPLIANCE FRAMEWORK

6.5.1. Environmental Duties of the Yen Bai PMU/Detail Design Consultants

At feasibility study/detail engineering design stage, the Yen Bai PMU shall work closely with the feasibility study consultants and detail design engineers to ensure that the greening/landscaping, environmental friendly solutions and relevant mitigation measures proposed in the ESIA/ESMP are considered and incorporated into the engineering design as appropriate.

During the preparation of TORs for consulting services and construction bidding documents, the Yen Bai PMU will also work closely with the consultants to ensure that: i) contract

packaging and cost estimations includes ESMP implementation, including the services on independent safeguard monitoring, environmental sampling/monitoring and compliance supervision, reporting etc.; ii) ECOPs and relevant common as well as site-specific mitigation measures are incorporated into the bidding documents; iii) environmental supervision and training are included in the scope of works assigned to the construction supervision consultant.

During construction phase, the Yen Bai PMU shall work closely with the supervision consultant to monitor the compliance of contractors and report to relevant authorities. The Yen Bai PMU will also direct the supervision consultant and contractors on the actions to be undertaken in case when issues are arisen, incidents or accidents etc.

The Yen Bai PMU will assign at least one staff with suitable qualifications to be Environmental Officer (EO) throughout project implementation. The EO will oversee environmental issues and monitor safeguard compliance of the subproject. The EO will be supported by the Independent Monitorign Consultant, the Environmetnal Officers of the construction supervision team as well as the contractors.

6.5.2. Environmental Duties of the Contractors

The contractor firstly shall adhere to minimize the impact that may be result of the project construction activities and secondly, apply the mitigation measures under ESMP to prevent harm and nuisances on local communities and environment caused by the impacts in construction and operation phases.

Prior to construction, the contractor will be required to prepare and submit a contractor's site-specific Environmental and Social Management Plan (Contractor's SEMP) to the CSC and PMU based on the ESMP of the project and requirement in the Specification of Bidding Document. The CESMP shall be certified by the CSC with subsequent submission to the PMU for approval. No construction activity should be implemented before approval of the CESMP.

Remedial actions that cannot be effectively carried out during construction should be carried out on completion of the works (and before issuance of the acceptance of completion of works).

The duties of the Contractor include but not limiting to:

- Compliance 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 Staffs of the CSC;
- Carry out any corrective actions instructed by the Environmental Staffs of the PPMU and CSC;
- In case of non-compliances/discrepancies, carry out investigation and submit proposals on mitigation measures, and implement remedial measures to reduce environmental impact;
- Stop construction activities, which generate adverse impacts upon receiving instructions from the Environmental Staffs of PPMU and CSC. Propose and carry out corrective actions and implement alternative construction method, if required, in order 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 ES of PPMU and CSC.
- In case the contractor proposes 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 –diligence environmental review of these materials sources to assess their compliance to national environmental requirements. Only complied sources can be used under DCIDP.

- The contractor shall be responsible for implementation of corrective measures at his costs. The contractor shall also be responsible for paying the costs of damages caused by non-compliance to ESMO and/or applicable environmental regulations.

6.5.3 Contractor's Environmental and Social Management Plan

After contract signing, based on the ESIA and contractual conditions, the contractor will prepare a CESMP for each contract package and submit to the CSC and PMU for review and approval.

The objective of the Contractor Environmental and Social Management Plan (CESMP) is to provide information for environmental management during the proposed works/activities on site of Hai Duong subproject. This is to ensure that the Contractor (and any subcontractors) have minimal impact on the environment. The CESMP will detail how the contractor will mitigate construction impacts and documents the contractor's response to inspecting, monitoring, verifying, internal auditing and correcting or improving environmental performance. The CESMP must be site-specific and should include details of control measures that will be implemented on site to minimize any potential environmental impacts from the proposed works/activities. If the proposed works/activities contained within the CESMP are altered during the Contract, the CESMP will be required to be modified by the Contractor to reflect these changes or modifications. The CESMP shall include the following contents:

(1) A statement of policy, providing a definition of the Contractor's environmental policy and an indication of commitment to the execution of its Site Environmental Management Plan.

(2) A brief document description; Date of issue; Revision status; Distribution list; and preparation personnel details and signoff.

(3) Applicable laws and regulations associated with the requirements in the subproject ESMP.

(4) Identification of the contractor licenses, permits and approval associated with the CESMP.

(5) Details on how the environmental impacts identified in the subproject ESIA will be managed on site, including: 1) the site-specific measures to mitigate impacts during construction (pages 195-213); 2) the risk and incident mitigation measures during construction (pages 214-215); 3) ECOPs (pages 218-231); 4) site-specific EMP (pages 231-247); and 5) the Contractor's Dredging Management Plan that the contractor is required to develop (page 287).

(6) Contractor's plan to carry out self-monitoring of implementation of the CESMP.

(7) Detailed environmental training that all site contractor personnel (including subcontractors) are required to undertake. As a minimum all contractor personnel working at the subproject sites must: i) be familiar and understand the CESMP for the works; ii) be aware of their environmental responsibilities and legal obligations on site; and iii) undertake health and safety and emergency response training.

(8) Specific capabilities, support mechanisms and resources necessary to satisfactorily implement the CESMP. Detailed environmental responsibilities of all contractor personnel

including subcontractors working on site with appropriate knowledge, skills and training for specific tasks shall be identified.

(9) The contractor shall be responsible for preparing monthly environmental reports, as a section within the Progress report required in the bidding document, including accidental report if any, for submitting to the subproject owner. The contents of these reports may include following details:

- Implementation of the Contractor's CESMP complying with the agreed program;
- Any difficulties encountered in the implementation of the CESMP and recommendations for remedying them for the future;
- The number and type of non-compliances and proposed corrective actions;
- Reports from the Subcontractors involved in the implementation of the CESMP, including minutes of meetings and discussions held by the Contractor;
- Minutes of meeting from discussions held with the subproject owner regarding implementation of the CESMP.

6.5.4 Contractor's Safety, Social and Environmental Officer (SEO)

The contractor shall be required to appoint competent staff(s) as the Contractor's on-site safety, Social and environmental officer (SEO). The SEO must be appropriately trained in environmental management and must possess the skills necessary to transfer environmentalmanagement 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 be limited to the following:

- Carry out environmental site inspections to assess and audit the contractors' site practice, equipment and work methodologies 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 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 ES of PPMU and CSC
- Inform the contractor and ES (of PPMU and CSC) of environmental issues, submit contractor's ESMP Implementation Plan to the ES of PPMU and CSC, and relevant authorities, if required;
- Keep detailed records of all site activities that may relate to the environment.

6.5.5 Independent Environmental Monitoring Consultant (IEMC)

The IEMC will be responsible for assisting the PMU in ESMP implementation. This also includes advising the CSC, contractors and communities on environmental compliance, and

carrying out the monitoring program in accordance with regulations and procedures of the Government and World Bank. Once the detailed operational implementation of the environmental monitoring program is discussed by PMU and World Bank, the IEMC will be responsible for quarterly checking, and supporting the PMU staff to supervise overall subproject activities to ensure that unified environmental protection policies of the Government and World Bank are applied and supervised during subproject implementation. The IEMC will be responsible to: (1) provide training and capacity building for construction management for PMU/ESU staff, including field engineers and/or consultants (CSC) in supervising the ESMP implementation of the contractor; (2) ensure active participation of the local communities and schools in the subproject areas, (3) monitor environmental parameters to assess the overall impacts of the subproject, and (4) establish environmental training program.

Specifically, the IEMC's responsibilities include:

- Ensuring that the approved ESMP and all subproject loan agreements related to environmental safeguards are fully applied and complied during subproject implementation.
- Assessing the effectiveness of mitigation measures which are provided by contractor and CSC in implementation process; providing proposals and recommendations to the PMU on necessary improvement and supplementation to meet the safeguard requirements.
- Reporting periodically (every 3 months) to the PMU on actual ESMP performance during subproject implementation.
- Establishing standard procedures, methods and forms to assist the PMU and CSC to assess contractors' progress in implementing required impact mitigation and monitoring measures.
- Assisting the PMU's environmental staff to review and check the related sections in the Contract Documents on the bidding packages for construction items of the subproject to ensure compliance with environmental protection policies and impact mitigation and monitoring requirements.
- Measuring, taking samples and monitoring periodically environmental parameters (once per 3 months) during the time of environmental monitoring contract.
- Assistance in the preparation of documents and implementation of training program on environmental monitoring and supervision for contractors, CSC and relevant staffs of PMU (environmental staffs and coordinators of packages).
- Via PMU, discussing with relevant enterprises (if necessary) to find suitable solutions for unexpected risks relating to environmental sanitation.

6.5.6 Environmental and Social Supervision during Construction (CSC)

During construction phase, a qualified CSC reporting to the PPMU shall carry out the environmental supervision. The CSC will assign environmental and social staff(s), will be 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 subproject are minimized. The CSC shall engage sufficient number of Environmental Supervision Engineers with adequate knowledge on environmental protection and construction subproject management to perform the required duties and to supervise the Contractor's performance. Specifically ES of CSC 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,
- Supervise contractor's implementation of its CESMP including their performance, experience and handling of site environmental issues, and provide corrective instructions;

- Review the ESMP implementation by the contractors, verify and confirm environmental supervision procedures, parameters, monitoring locations, equipment and results;
- Arrange, implement training on HIV/AIDS awareness rising for all workers, the local community, CSC team and PPMU staff.
- Report ESMP implementation status to PPMU and prepare the environmental supervision statement during the construction phase;

6.5.7 Compliance with Legal and Contractual Requirements

- The constructions activities shall comply not only with the general contractual condition on environmental protection and pollution control requirements in the bidding document, the subproject ESMP, and the CESMP, but also with environmental protection and pollution control laws of the Socialist Republic of Viet Nam.
- All the works method statements submitted by the Contractor to the CSC and PMU for approval to see whether sufficient environmental protection and pollution control measures have been included.
- The CSC and PMU shall also review the progress and program of the works to check that relevant environmental laws have not been violated, and that any potential for violating the laws can be prevented.
- The Contractor shall copy relevant documents to the SEO and the ES of CSC and PMU. The document shall at least include the updated work progress report, the updated work measure, and the application letters for different license/permits under the environmental protection laws, and all the valid license/permit. The SEO and the ES shall also have access, upon request, to the Site Log-Book.
- After reviewing the documents, the SEO or the ES shall advise the PMU and the contractor 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 SEO 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 measure or may result in potential violation of environmental protection and pollution control requirements, they shall advise the Contractor and the PMU accordingly.

6.5.8 Environmental Claims and Penalty System

- In the compliance framework, if non-compliance with the Contractor's ESMP and environmental regulations are discovered by CSC/ES/IEMC/PMU during the site supervision, 2% values of interim payment of the contractor of this month will be held back. The Contractor will be given a grace period (determined by CSC/PMU) to repair the violation. If the Contractor satisfactorily performs the repairs within the grace period (confirmed by CSC/PMU), no penalty is incurred and the uphold money will be paid to the contractor. However, if the Contractor fails to successfully make the necessary repairs within the grace period, the Contractor will pay the cost for a third party to repair the damages (deduction from uphold money).
- In case of IEMC/CSC/PMU not detected of non-compliance with environmental regulations of the contractor, they will be responsibility payment to repair the violation.

6.5.9 Reporting Arrangement

ESMP monitoring and reporting requirements are summarized in Table 51 below

Table 51: Regular reporting requirements

No.	Report Prepared by	Submitted to	Frequency of Reporting
1	Contractor to the Employer	PPMU	The Contractor is obliged to report (immediately of certain aspects and monthly with respect to a wider range of aspects) to the CSC
2	Construction Supervision consultant (CSC)	PPMU	The CSC is required to report to the employer every weekly and monthly
4	Community Monitoring	PPMU	When the community has any complaint about the subproject safeguards implementation
5	PPMU	DONRE	PPMU is required to report to DONRE every six-month in accordance with Gov's regulations
6	PPMU	WB	PPMU is required to report to WB every six-month in accordance with the Section II of the Loan Agreement

6.6. ENVIRONMENTAL MONITORING PROGRAMME

6.6.1. Supervision of contractor's implementation of safety measures

Three safety supervision levels will be implemented: frequent supervision, periodical supervision and supervision by community, namely:

- *Frequent supervision:* will be executed by CSC assigned by PMU. CSC will include the supervision outcomes in the project progress report.
- *Periodical supervision* (once/6 months): is a part of general monitoring of ESMP. SEO assisted by the IEMC will supervise the contractor's implementation once/6 months and the results will reported to PMU,WB and DONRE of Yen Bai.
- *Supervision by community:* Supervision by local community will be implemented in accordance with the procedures stipulated by the Governmen with technical and managerial assistance from PMU.

6.6.2. Environmental quality monitoring

Environmental quality monitoring will be implemented in the construction phase in accordance with the contents presented in the following table and the specific locations are stated in the appendices.

Table 52: Content of environmental monitoring sample

No.	Monitoring items	Construction phase
I	*Noise, vibration monitoring*	
	1. Monitoring parameter	Noise, vibration
	2. Monitoring frequency	Once every 3 months
	3. Monitoring locations	15 locations for subproject items

No.	Monitoring items	Construction phase
	4. Comparative standard	QCVN 26:2010/BTNMT, QCVN 27:2010/BTNMT
II	*Air quality monitoring*	
	1. Monitoring parameter	TSP, CO, NO_2, SO_2, HC, micro-climate
	2. Monitoring frequency	Once every 3 months
	3. Monitoring locations	QCVN 05 : 2013/BTNMT, QCVN 06:2009/BTNMT
	4. Comparative standard	**14** locations for subproject items
III	*Surface water quality monitoring*	
	1. Monitoring parameter	temperature, pH, DO, TSS, BOD5, COD, lubricant, Coliform
	2. Monitoring frequency	Once s every 6 months
	3. Monitoring locations	QCVN 08-MT:2015/BTNMT
	4. Comparative standard	**10** locations for subproject items
IV	*Underground water quality monitoring*	
	1. Monitoring parameter	pH, DO, TSS, BOD5, COD, DO lubricant, Coliform
	2. Monitoring frequency	Once every 6 months
	3. Monitoring locations	QCVN 09-MT:2015/BTNMT
	4. Comparative standard	**10** locations for subproject items
V	*Wastewater quality monitoring*	
	1. Monitoring parameter	pH, temperature, DO, TSS, BOD5, COD, DO, lubricant, Coliform
	2. Monitoring frequency	Once in every 3 month-period
	3. Monitoring locations	QCVN 14:2008/BTNMT
	4. Comparative standard	**10** locations for subproject items
VI	*Mud/soil*	*Taking one sample before construction. Implemented when necessary*
	1. Monitoring parameter	As, Cu, Pb, Zn, Cd
	2. Monitoring frequency	Once before construction
	3. Monitoring locations	QCVN 03-MT:2015/BTNMT
	4. Comparative standard	**8** locations for subproject items

No.	Monitoring items	Construction phase
VII	*Deposit mub*	*Taking one sample before construction. Implemented when necessary*
	1. Monitoring parameter	As, Cu, Pb, Zn, Cd
	2. Monitoring frequency	Once before construction
	3. Monitoring locations	QCVN 43:2012/BTNMT
	4. Comparative standard	**7** locations for subproject items
VIII	*Erosion monitoring*	*During the construction*
IX	*Waste monitoring*	*During the construction*

Number of environmental monitoring samples during the monitoring process are as follows:

Table 53: Quantity of environmental monitoring samples

Item	Total construction time (months)	Monitoring frequency (month/time)	Number of monitoring times (times)	Number of air, noise, vibration samples	Number of wastewater sample	Number of surface water sample	Number of under-ground water sample	Mub/soil sample	Mud deposit sample
1	24	3-6	8	2	1	1	1	0	5
2	24	3-6	8	1	1	1	1	1	0
3	24	3-6	8	1	1	1	1	1	0
4	24	3-6	8	2	1	1	1	1	1
5	24	3-6	8	2	1	1	1	1	1
6	18	3-6	6	1	1	1	1	1	0
7	24	3-6	8	3	1	1	1	2	0
8	24	3-6	8	2	3	3	3	1	0
9	10	3-6	3	0	0	0	0	0	0
10	3	3-6	1	0	0	0	0	0	0
11	3	3-6	1	0	0	0	0	0	0
12	3	3-6	1	0	0	0	0	0	0
13	3	3-6	1	0	0	0	0	0	0
	Sample/time		**1**	**14**	**10**	**10**	**10**	**8**	**7**
	Total samples	**3-6**	**8**	**110**	**78**	**39**	**63**	**8**	**7**

On top of environmental monitoring plan, social monitoring during the execution process should also be reviewed and implemented. Specifically:

(i) Labour safety supervision (every 3 months) focusing on work log, safety and warning

signs, number of accidents, injuries and losses.

(ii) Environmental hygiene supervision (every 3 months) focusing on quality and hygienic conditions of tools; first-aid kit, medical box, number of food poisoning cases, number of disease infected people, propagandising plan of public healthcare.

These findings will serve as important criteria for assessment of the suitability and responsiveness of workers on worksite and the existing labour safety, thereby making appropriate and efficient adjustments.

Environmental quality supervision in the operation phase such as ambient air, surface water, wastewater and underground water is included in Yen Bai city's general plan. Other supervisions such as erosion, embankment erosion, road, road and railroad accidents, etc. shall be incorporated into the operation plan of the firm taking over the works. Therefore, a concrete opration plan will not be presented in this section of the Report.

6.4. CAPACITY BUILDING PROGRAM

6.4.1. Safeguard management of PMU

Yen Bai City Investment and Construction Management Unit currently has a team of over 19 staffs, 100% of which have university education; 5 of which have master degree. Most of the project management staffs are recruited from other PMUs and specialised firms in transport and communications (68.4%), water resources (5.3%), environment (5.3%) and finance-accounting (21.1%), having high qualification and capability. Over 50% of the PMU's personnel have previously worked for other PMUs or consulting firms.

The managing team of Yen Bai City Investment and Construction Management Unit is young (officials aged under 40 make up 80%), in which, 33% of the personnel have less than 10 year working experience, 37% have 10-20 years of experience and 32% from 20 years upwards. The staffs have adequate project management capability and skills, including both hard skills (technical skills to perform professional duties in the project) and soft skills (communication, negotiation skills…) to coordinate with the project-related agencies, especially ODA projects and multi-sector projects.

In managing these projects, PMU's team has gained a wealth of experience in organising and managing projects for transport infrastructure development, urban upgrading, irrigation works rehabilitation, etc., including social and environmental safeguard considerations.

PMU's team has been informed of the sub-project's potential environmental issues, impacts, risks as well as mitigating measures and managing plans through the tasks they carry out during the preparation of ESIA for the sub-project. PMU arranged and proactively participated in site surveys and affected community consultation during the preparation of safeguard documentation of the sub-project, namely ESIA, RP. In the pre-feasibility study stage, PMU delegated specific tasks to officials with technical, technological, environmental and social managing capacity. This sub-project is not the first project financed by WB undertaken by PMU; however, many WB's environmental and social safety procedures have been updated over the time. Thus, it is advisable that PMU's staff be trained on actual experience with environmental and social management during the construction and operation phases of the sub-project.

6.4.2. Safeguard management capacity building program

The lack of construction safety management experience will be identified by the construction supervisor who will also take charge of environmental supervision during the construction period, Independent Environmental Supervision Consultant will provide some

training activities and compliance check, which will be closely supervised by the Task force of WB during the construction period.

The following table provides a typical training program on safeguard policies. PMU and IEMC with the support of the Technical Support Team will provide training to construction contractor, CSC, and other groups.

- *Target group:* Staff of PMU, safety and environment officials (SEO), field engineers (FE), construction supervision consultant (CSC), representatives of construction contractors of related parties and of communities in the sub-project area. Construction contractors are responsible to train their labours and drivers.
- *Training schedule:* Training will be provided 1 month before or at the commencement of the first construction project. The training can be adjusted in line with the implementation schedule of the sub subproject/contracts.
- *Training frequency:* The basic training program given in the table below will be provided every 6 months, with the contents being adapted and updated for each specific work item. Training program for PMU's staff is provided during the first year of the sub-project. Three days of training for CSC and contractors are also planned to take place twice a year.

Table 54: Training Programs for Environmental Supervision

I. Objects	**PMU**
Training course	Environmental supervision and reporting
Participants	Environmental staffs and environmental managers
Training frequency	Soon after subproject effectiveness but at least 1 month before the construction of the first contract. The follow-up training will be scheduled as needed.
Duration	2 days
Contents	General environmental management relating to subproject including requirements of WB, MOET, cooperating with competent authorities and relevant enterprises • Requirements on environmental supervision; • Supervision and implementation of mitigation measures; • Community participation in environmental supervision • Guide and supervise contractor, CSC, and community representatives in implementation of environmental supervision. • Forms used in environmental supervision; • Risk response and control; • Receiving approach and submit forms. • Other areas to be determined;
Responsibilities	PMU, with support of the Technical Assistance team and IEMC for the implementation of safeguards
II. Objects	**CSC, CONTRACTOR, COMMUNE/WARDS AUTHORITIES, COMMUNITY REPRESENTATIVES**
Training course	Implementation of mitigating measures

Participants	CSC; on-site construction management staffs; environmental staffs of contractor; commune/ward/group authorities
Training frequency	Soon after bidding, update based on requirements
Duration	Two days of training for CSC and contractors and oen day of training for others
Contents	• Overview of environmental monitoring; • Requirements of environmental monitoring; • Role and responsibilities of contractors and CSC • Content and methods of environmental monitoring; • Response and risk control; • Propagate monitoring forms and guide how to fill in the forms and risk report; • Other areas to be determined.
Resposibilities	PMU, with support of the Technical Assistance team and IEMC for the implementation of safeguards
III. Objects	**COMMUNITIES AND WORKERS**
Training course	Environmental sanitation and safety
Participants	Representatives of workers (leaders) directly engaged in the work items of the sub-project
Training	As appropriate
Duration	One-day presentation and one-day on-the job training
Contents	• Preliminary presentation on environmental protection and environmental overview • Key issues that require community and workers attention to minimize safety risks (roads, equipment, machines, etc.) as well as reduce pollution (dust, fume gases, oil/grease spill, waste management, etc.) • Management of environmental safety and sanitation in work sites and worker camps • Mitigating measures at construction site and work camps; • Safety measures on electricity, mechanical, transportation, air pollution; • Procedures to deal with emergency situation • Other areas to be determined;
Resposibilities	CSC, Contractor, PMU

6.5. COST ESTIMATION

The cost of ESMP implementation will include (i) the costs of implementing mitigating measures by the contractor, (ii) expenses supervised by CSC, (iii) cost of the independent environmental monitoring consultant (IEMC), including the costs of environmental quality monitoring, (v) the cost of safety management for the PMU, including both technical assistance in implementing safety policies and training programs.

(a) The costs of implementing mitigating measures during construction will be a part of the value of construction contracts

(b) Safeguard policy during construction: the costs for a site-specific environmental monitoring plan (SEMP) by the construction supervision consultant (CSC) will be provided in construction supervision contracts.

(c) PMU specialised team for environmental safeguard

The costs of the PMU operations relating to EMP are allocated from the subproject management budget of the PMU, including safety training programs, and basic allowances to participants in the monitoring programs. After the subproject has been completed, the costs of environmental monitoring of constructed works will be taken from the operation and maintenance budget of the agency taking over the work items.

(d) Costs of environmental monitoring are estimated as follows:

Table 55: Costs of environmental monitoring during the execution of the works

No.	Sample	Unit price (VND)	Quantity (sample)	Total (VND)	Total (USD)
I	**Air sample**				
1	TSP	280,000	110	30,800,000	1,400
2	CO	140,000	110	15,400,000	700
3	NO_2	140,000	110	15,400,000	700
4	SO_2	140,000	110	15,400,000	700
5	HC	350,000	110	38,500,000	1,750
6	Noise	224,000	110	24,640,000	1,120
7	Vibration	70,000	110	7,700,000	350
8	Mico-climate	168,000	110	18,480,000	840
II	**Wastewater**				
1	Temperature	4,000	78	312,000	14
2	pH	56,000	78	4,368,000	199
3	DO	104,000	78	8,112,000	369
4	TSS	80,000	78	6,240,000	284
5	BOD5	200,000	78	15,600,000	709
6	COD	120,000	78	9,360,000	425
7	Grease/Oil	500,000	78	39,000,000	1,773
8	Coliform	112,000	78	8,736,000	397
III	**Surface water**				
1	Temperature	4,000	39	156,000	7
2	pH	56,000	39	2,184,000	99
3	DO	104,000	39	4,056,000	184
4	TSS	80,000	39	3,120,000	142
5	BOD5	200,000	39	7,800,000	355
6	COD	120,000	39	4,680,000	213
7	Grease/Oil	500,000	39	19,500,000	886
8	Coliform	112,000	39	4,368,000	199
IV	**Ground- water**				
1	Temperature	4,000	63	252,000	11
2	pH	56,000	63	3,528,000	160
3	DO	104,000	63	6,552,000	298
4	TSS	80,000	63	5,040,000	229
5	BOD5	200,000	63	12,600,000	573
6	COD	120,000	63	7,560,000	344
7	Grease/Oil	500,000	63	31,500,000	1,432
8	Coliform	112,000	63	7,056,000	321
V	**Waste - soil and stone sample**				
1	As	150,000	8	1,200,000	55
2	Cd	130,000	8	1,040,000	47
3	Cu	130,000	8	1,040,000	47
4	Pb	130,000	8	1,040,000	47

5	Zn	130,000	8	1,040,000	47
VI	**Sludge sample**				
1	As	150,000	7	1,050,000	48
2	Cd	130,000	7	910,000	41
3	Cu	130,000	7	910,000	41
4	Pb	130,000	7	910,000	41
5	Zn	130,000	7	910,000	41
Total				**388,050,000**	**17,639**

Monitoring and supervising costs for the operation phase are included in Yen Bai City's general environmental monitoring plan, while road and embankment supervising cost is included in the cost for maintenance of the works.

The community engagement in the implementation of ESMP is totally voluntary. However, to encourage the community engagement, the costs for materials, equipment and tools used for supervison and responsibility allowances for a few individuals who are nominated by the community to participate in the supervision will be allocated under Decision no. 80/2005/QD-TTg dated 18 April 2005 by the Prime Minister providing Regulations for supervising community's investment and Joint Circular guiding the execution of Decision no.80/2005/QD-TTg.

(e) Independent environmental supervising costs are estimated as follows:

Table 56: Cost estimate for the independent environmental supervising package

No	Contents	Unit	Qty	Unit price (VND)	Amount (VND)	Amount (USD)
1	Expert remuneration	Person_ month	72	30,000,000	2,160,000,000	98,182
2	Accommodation, per diem	Person_ day	40	500,000	20,000,000	909
3	Travelling expense	Trip_ person	30	1,000,000	30,000,000	1,364
4	Training organisation	Class	13	3,000,000	39,000,000	1,773
5	Office supply and communications	Supervisi ng batch	24	2,200,000	52,800,000	2,400
	Total				**2,301,800,000**	**104,627**

(f) Costs for training and capacity enhancing for Contractor, CSC, safety officers on worksite, and the local communities are shown in the table below:

Table 57: Cost estimate for training and capacity building

Contents	Objects	Unit	Qty	Unit price	Amount	
				VND	*VND*	*USD*
I. Environmental supervision and report training						
PMU	Environmental officers; managing officers in charge of environmental issues	Training course	2	10,000,000	20,000,000	909.09
II. Implementation of mitigation measures						
CSC	CSC; civil engineer, site manager	Training course	4	10,000,000	40,000,000	1,818.18
Contractor	(CSC; civil engineer, site manager	Training course	4	10,000,000	40,000,000	1,818.18
Locality	Ward/commune authorities; HHs in the sub-project area	Training course	1	10,000,000	10,000,000	454.55
III. Safety and environmental sanitation						
Contractor	Workers diretcly carrying out the works Environment and safety officers	Training course	2	5,000,000	10,000,000	454.55
Locality	Ward/commune authorities; HHs in the sub-project area	Training course	2	5,000,000	10,000,000	454.55
Total					**130,000,000**	**5,909**

(g) Funding for training on HIV / AIDS by the contractor and CSC implemented are mentioned as follows:Summary of cost for implementation of ESMP:

Table 58: Funding estimate for training on HIV / AIDS

Contents	Objects	Unit	Qty	Unit price	Amount	
				VND	*VND*	*USD*
HIV / AIDS training cost for construction contractors and consultants and community						
CSC	CSC; civil engineer, site manager	Training course	7	20,000,000	140,000,000	6,364
Contractor	(CSC; civil engineer, site manager					
Locality	Ward/commune authorities; HHs in the sub-project area					

Table 59: Cost estimate for implementation of ESMP

Description	Total cost (million USD)	Source of fund
(a) Minimisation during construction	As part of the contracts	WB
(b) Safeguard policy supervision during construction	As part of the cost for employing CSC	WB
(c) PMU specialised team of environmental safeguard policies	As part of the cost for PMU	Counterpart fund
(d) Environmental quality supervision	0.018	WB

Description	Total cost (million USD)	Source of fund
(e) Independent environmental monitoring consultant (IEMC)	0.107	WB
(f) Capacity building program for safeguard policies	0.006	WB
(g) HIV / AIDS training cost for construction contractors and construction supervision consultants and community	0.006	WB

6.6 GRIEVANCE REDRESS MECHANISM (GRM)

Under the laws of Vietnam, citizen's rights to voice complaints is protected. As part of the sub-project, a grievance redress mechanism (GRM) will be developed by SEO of PMU, according to which, persons in charge will be designated and contacts will be established. The sub-project ensures that the complaints will be addressed and resolved at the lowest level as soon as possible. This mechanism will provide a framework in which any complaints about environment and safety may be handled and any grievance and dispute may be resolved in a timely manner. GRM will be made avalable prior to the commencement of the construction works.

During the construction of the works, GRM will be managed by the contractor under the supervision of CSC. The contractors will inform the affected communities of the GRM availability to handle the complaints and concern about the sub-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. The contractors should indicate contact for any complaints when the contractors announce construction schedule to local communities.

All complaints and corresponding actions undertaken by the contractors will be recorded in subproject safeguard monitoring reports. Complaints and claims for damages could be lodged as follows:

- Verbally: direct to the CSC and/or the contractors' safeguard staffs 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 staffs or representatives.

Upon receipt of a complaint, the CSC, the contractors' safeguard staffs 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 staffs, one copy will be forwarded to the CSC, and the fourth copy to the PMU 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.

World Bank Grievance Redress Mechanism*:* Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported subproject may submit complaints to existing subproject-level grievance redress mechanism or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address subproject-related concerns. Subproject affected communities and individuals may submit their complaints to the WB's independent Inspection Panel which determines whether harms occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the WB's attention, and 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 Inspection Panel, please visit www.inspectionpanel.org.

CHAPTER 7. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

7.1. OBJECTIVES AND PRINCIPLES OF PUBLIC CONSULTATION

The environmental impact assessment, public consultation and information disclosure are to seek acquiescence from local government and NGOs and affected communitites in the sub-project area. Community engagement is one of fundamental conditions to ensure their support and to express their opinions on the sub-project.

In fact, if the community is engaged in the sub-project right from the preparation phase, the relationship, information exchange and update among the sub-project stakeholders and the community will be much better and the sub-project will thereby receive valuable recommendations from the local communities.

The objectives of public consultation were as follows:

- To share all information on the items and tentative activities of the Subproject with local community and stakeholders;
- To gather opinions/comments and concerns from local authorities and the community on local particularities and environmentally sensitive matters in the subproject area, especially matters that the environmental assessment impact group has not been aware of. On such basis, the concerns of the local community may be proposed for proper settlement during the selection of subproject design options;

+ Public consultation in ESIA report must adhere to:

  - WB's policies on environmental assessment (OP/BP 4.01) and involuntary resettlement (OP/BP 4.12) requiring consultation and notification to potentially affected people and local authorities of the environmental and social issues during the sub-project preparation.
  - Section 4, Article 12, Resolution no. 18/ND-CP dated 14 February 2015 of the Government on information disclosure and consultation with the communities affect by the project.

7.2 SUMMARY OF PUBLIC CONSULTATION PROCESS

7.2.1. Participants

Participants include representative of ward/commune People's Committee and Fatherland Front Committee, officials in charge of relevant areas, heads of residential quarters/ heads of the hamlets, affected HHs and beneficiaries of the sub-project, representatives of the Prject Owner and Consultant.

7.2.2. Consultation methods

Pursuant to Law on Environment Protection 2014 of Vietnam and policy OP4.01 of World Bank, representative of the Project Owner – Investment and Construction Project Management Unit issued letter no. 809/CV-BQL dated 16 August 2017 on public consultation for the preparation of ESIA Report for Dynamic Cities Integrated Development Project– Yen Bai City, Yen Bai Province Sub-project to the relevant ward/commune People's Committees.

Meetings with the related wards/communes were held and attended by the aforesaid participants. Opinions were given after the Project Owner's presentation of overview of main contents and work items of the sub-project, financial resources for implementation of

the sub-project, technical options for 13 work items of the sub-project. Environment consultant presented ESIA and ESMP of the sub-project, including impacts, mitigating measures and work plans. Potential incidents and risks that may arise from the construction of the works were also clearly stated.

Representatives of ward/commune People's Committees and attendants of the meetings discussed and gave opinions, comments, recommendations and consultancy on technical options for evaluation and selection of options and implementation of negative impact mitigating measures.

7.2.3. Consultation process

The consultation process was divided into 2 consultation batches: first batch in April-May 2017 and second batch in August-September 2017. Below is a summary of the consultation process:

Table 60: Public consultation process – Yen Bai City Sub-project

No.	Location	Time	No of participants (persons)	Invested items under subproject
1	Minh Tan ward PC	13 April 2017	10	- Cau Dai stream flood control embankment construction - Construction of a road from Dien Bien road to the road from Bach Lam bridge to Van Phu bridge
		15 August 2017	7	
2	Nam Cuong ward PC	19 April 2017	7	- Rehabilitation of 3 Nam Cuong balancing lakes
		07 August 2017	8	
3	Van Phu commune PC	27 April 2017	19	- Construction of a road from Dien Bien road to the road from Bach Lam bridge to Van Phu bridge
		10 August 2017	17	
4	Dong Tam ward PC	27 April 2017	22	- Cau Dai stream flood control embankment construction - Hao Gia stream flood control embankment construction
		14 August 2017	15	
5	Yen Ninh ward PC	27 April 2017	8	- Cau Dai stream flood control embankment construction - Construction of a road from Dien Bien road to the road from Bach Lam bridge to Van Phu bridge - Construction of a road from Bach Lam bridge to Van Phu bridge
		15 August 2017	10	
6	Tan Thinh commune PC	2 May 2017	14	- Construction of a road connecting Nguyen Tat Thanh intersection with Au Co intersection
		13 August 2017	12	
7	Yen Thinh commune PC	3 May 2017	17	- Hao Gia stream flood control embankment construction
		8 August 2017	14	

The consultation meetings were held and attended by the aforesaid participants with a total of 119 participants in 2 consultation batches in 7 wards and communes of Yen Bai City.

Opinions were voiced after representative of the Project Owner's presentation of the sub-project's work items, funding sources and work schedule. The Consultant presented the

summarised ESIA Report, including impacts, proposed mitigating measures and social and environmental management plan. Feedbacks were consulted and recorded in these meetings.

7.3. PUBLIC CONSULTATION RESULTS

7.3.1. First consultation

Summary of the comments in the first meetings in the wards/communes:

- Make public the compensation and support unit prices and resolve people's complaints (if any) in a timely manner.
- Watering roads to reduce dust, avoiding drop of materials which may cause dust and traffic congestions.
- Material transportation must adhere to the required load and road grade.
- Waste must not be discharged into the water canals.
- Reinstating the facilities, especially roads seriously damanged by the construction process.
- Taking environmental protection measures during the construction.

Comments are detailed in the table below:

Table 61: First public consultation – Yen Bai City sub-project

No	Items	Ward/commune	Comments	PMU's opinions
1.	Rehabilitation of 3 Nam Cuong lakes	Nam Cuong	Construction should not be carried out in January and ghost festival as Nam Cuong is the main site of festival	- To be incorporated into the construction methods
2.	Construction of Cau Dai stream flood control embankment	Yen Ninh, Minh Tan, Dong Tam	- Civil road should be connected to the embankment route	- To be designed as appropriate
			- Key sections should be executed first and early notice should be given to the local people	- Close co-ordination with local authorities
3.	Construction of Hao Gia stream flood control embankment	Dong Tam, Yen Ninh	- Bypass drainage should be improved because construction materials may fall down, causing flow congestion	- To be reviewed and designed as appropriate
4.	Construction of a road from Bach Lam bridge to Van Phu bridge	Van Phu	- Suitable loads and road grades for material transportation must be considered to prevent damage to rural roads.	- To be incorporated into the construction methods
			- A railway runs near Bach Lam bridge, so labour safety should be ensured for workers during the execution of the works. The transportation of materials should be strictly handled to prevent	- To be incorporated into the construction methods

No	Items	Ward/commune	Comments	PMU's opinions
			materials from falling down on the railway, which may affect the railway operation.	
5.	Construction of a road connecting Nguyen Tat Thanh intersection with Au Co intersection	Tan Thinh	Build retaining wall with stone and slope; the flow variations from the mountain downwards should be reflected in the detailed design; local people should be consulted for information about the actual developments within the past 100 consecutive years.	- To be reviewed and designed as appropriate
			Prevent fertile top soil from being washed away to reduce crop losses	- To be incorporated into the construction methods

7.3.2. Second consultation

Below are a summary of the opinions in the second consultation meetings:

- Reasonable compensation and resettlement support unit prices should be established to enable HHs whose land evicted and who are to be relocated to buy new land and build new houses.
- Compensation and resettlement support amount must be higher than price of a resettlement lot in the sub-project, otherwise, support should be provided in case compensation money is not enough to buy a resettlement lot. This is to avoid them from becoming poor HHs because the whole money has been spent to buy resettlement land or build new house, poor health, end of working age, etc.
- Xây dựng phương án và bố trí mặt bằng tái định cư khi thực hiện thu hồi đất (điều kiện tốt hơn hoặc bằng nơi ở cũ). Resettlement plan and resettlement site plan should be prepared (with better or equal conditions)
- During the construction of the works, transportation of construction materials and solid waste should be strictly controlled to prevent them from falling down on the river, lakes and streams, causing flow congestion, especially in rainy season, and flooding.
- Prepare detailed construction plan for each section/route.
- Information should be publicised and speakers should be used to make information available to everyone.
- Closely coordinate with local governments during the construction.

Below is a summary of the comments:

Table 62: Second consultation – Yen Bai City sub-project

No	Items	Ward/commune	Comments	PMU's opinions
1			- Rescue instruments should be arranged for works on the lakes in case of accidents	- This will be incorporated into the construction methods to ensure labour safety

No	Items	Ward/commune	Comments	PMU's opinions
	Rehabilitation of 3 Nam Cuong lakes	Nam Cuong	- The compensation and subsidies must be suitable with the land area acquired by the sub-project. The compensation and support unit prices must be agreed upon by the people in the meetings. - The compensation and support procedures must be clear, transparent and simple.	- The inventory of losses will be jointly conducted by local authorities and affected HHs
2	Construction of Cau Dai stream flood control embankment Construction of Hao Gia stream flood control embankment	Yen Ninh, Minh Tan, Dong Tam Dong Tam, Yen Ninh	- Build resettlement sites prior to land acquisition so that resettled HHs have new accommodation in avoidance of multiple resettlements.	- To be reviewed and incorporated into the construction methods to minimise multiple resettlements
			- Disposal sites are located along Cau Dai embankment. So impacts from the transportation of waste materials on the residential areas here should be controlled.	- To make this a requirement for the firm doing the daily waste material transportation and treatment.
			The construction should be carried out promptly to ensure smooth flow and prevent flooding.	- To be incorporated into the contractor's construction methods right from the bidding stage.
3	Construction of Cau Dai stream flood control embankment	Yen Ninh, Minh Tan, Dong Tam	- HHs with land evicted should be permitted to convert the land use purpose in the case their remaining agricultural land suffices for them to live on and they can resettle right there without much disturbance.	- HHs whose homestead land evicted will be entitled to convert the land use purpose in respect of other types of land remaining as they wish
4	Construction of a road from Bach Lam bridge to Van Phu bridge	Văn Phú	- Yearly plan should be made and adhered to in order to avoid pending plan, which will negatively affect local people's life, for instance: within the planned land acquisition area, the conversion of land use purpose, construction and repair of houses, trading, assignment and offering of houses and land, etc. are banned, giving rise to grievances among local people and difficulties in land management for local authorities.	- Upon completion of inventory of affected land areas and properties thereon, the subsequent steps under the sub-project will be taken to meet the work schedule and minimise negative impacts on local people.
			- During the soil filling and compaction, attention should be paid to avoid impacts on the nearby agricultural land which may cause local flooding and impacts on	- To be supplemented as a requirement for construction contractor

No	Items	Ward/commune	Comments	PMU's opinions
			houses and architectural objects of nearby HHs.	
5	Construction of a road connecting Nguyen Tat Thanh intersection with Au Co intersection	Tân Thịnh	The inevitable problems encountered from the construction of the works including blocked irrigation ditches, damage to houses and other structures adjacent to the worksite should be jointly dealt with by the local governments and the sub-project to avoid prolonged complaints and petitions to upper level, which may also delay the progress of the sub-project.	- To work out reasonable construction methods to minimise impacts on the nearby communities. In the events of inevitable impacts, the Project Owner will coordinate closely with local authorities to resolve.
			- Resettlement site must be large enough for HHs and price of 1 resettlement lot must be reasonable. Price of a resettlement lot in commune must be lower than that in ward.	- To be reviewed for suitable design and ensure equal or better living conditions for local people.
6	Construction of a road from Dien Bien road to the road from Bach Lam bridge to Van Phu bridge	Yen Ninh, Minh Tan	- Dien Bien is the trunk road of Yen Bai Province and is favourable for trading. Therefore, price of land to be acquired on this road must be higher than the Government's price. Survey of replacement price should be conducted to ensure legitimate benefits for local people.	- To conduct replacement price survey for wards and communes under the sub-project

The opinions from the community and local authorities were raised straightforwardly to the Project Owner. The Project Owner agreed with their opinions and acknowledged their recommendations as bases for improvement of impact mitigating measures during the construction, operation and social-environmental monitoring process.

Below are some pictures of the consultation sessions:



Figure 59: Some pictures of first public consultation sessions

Figure 60: Some pictures of second public consultation sessions

7.4. INFORMATION DISCLOSURE

The first draft was provided to ward/commune PCs in 5 wards and 2 communes in Yen Bai city. About 7 days before the second public consultation session (August 2017), the Consultant gave a notice to the local governments of the public consultation plan, time, venue, participants and issues to be discussed. The first information disclosure was made on 30 October 2017.

The second draft ESIA was published on website of Yen Bai Province People's Committee and offices of 7 ward/commune People's Committees on 25 November 2017. Any disagreements from the HHs and local authorities on the contents of ESIA wasl constituted a reason for another public consultation session. This final draft ESIA in English was disclosed at the World Bank's internal and external websites on November 28th, 2017.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1**. The "Dynamic Cities Integrated Development Project – Yen Bai City, Yen Bai Province Sub-project"** is a project for improvement and rehabilitation of existing infrastructure conditions, enhancement of urban sanitation, creating incentives for sustainable growth of the city. The sub-project focuses on flood control and minimisation of damage caused by flood and rain as well as transport connectivity to promote commodity and service trading. The overall impact of the sub-project is positive and responsive to local people's demand for urban services.

2. This is among the projects that presents many positive social and environmental impacts to Yen Bai city and Yen Bai Province in particular and the Midlands and Northern mountainous region in general. As such, the sub-project is expected to meet local people's longing for a clean living environment that would beautify the urban landscape and attract tourists and investors.

3. Major environmental issues that may arise from the land acquisition are:

- Transform of land use purpose in respect of the work items: loss of residential land, farming land and existing structures, etc., of local HHs, agencies and businesses.
- Direct impacts on land owners in the sub-project area in respect of agricultural production, living, cultural and religious activities.

4. Environmental and social issues arising from the construction of work items are:

- Sludge from the dredging of Hao Gia, Khe Dai streams and Nam Cuong lakes.
- Gases, fumes and noises caused by motorised vehicles and construction equipment and machinery on the worksites; the construction of culverts, rainwater drainage and water supply systems on the embankment routes, roads and resettlement sites.
- Domestic wastewater and wastewater generated by workers in temporary camps;
- Solid waste of workers and construction waste on the worksites.
- Traffic disturbance and increased risks of traffic accidents
- Social impacts.
- Losses or interruptions to the related services
- Health and safety of local community and workers on the worksites.

The above impacts occur only in a short period of time at low and medium levels, affecting workers and residents around the construction sites and can be minimised by appropriate measures as indicated in Chapter 5.

5. Environmental impacts during the execution of the sub-project:

- Gas, vibration and noise emitted from the operation of vehicles on the embankment routes, roads and resettlement sites;
- Domestic wastewater from nearby residential areas;
- Domestic waste of the residential areas and businesses along the roads;
- Potential environmental incidents such as: collapse/settlement, crack on surface of the works, especially for the embankments, bridges and roads.
- Increased accidents as smooth traffic flow on newly opened roads will raise the traffic volume.

- Potential railway accidents as road no.2 and resettlement site no.4 are adjacent to Ha Noi – Lao Cai railway;
- Potential accidents: falling into sewers, streams, lakes.

The impacts that may arise in the operation phase are mild, yet affecting people's health and life. Mitigating measures therefor has been proposed in Chapter 5 hereinabove.

7. Environmental-social management plan will be strictly implemented by the Project Owner, Design Consultant, Contractor, operation and management firm with support and guidance from the local environment managing agencies. Objectives of environmental-social management plan are to strictly control and curb the negative environmental changes; proactively respond to possible incidents.

8. **Given the strict conformity to the stipulations of laws on environment** and recommendations for minimisation of environmental pollution mentioned hereunder, the sub-project will definitely operate successfully, bringing about positive socio-economic-environmental impacts, creating motivation for the development of the city, the Midlands and Northern mountainous regions.

RECOMMENDATIONS

1. Local environment State management agencies should support the Project Owner to enhance capacity of its staff and train operation and management technicians; organise propaganda to strengthen local people's awareness of environmental protection.

2. Given the extended construction period (tentatively 3 years), updates on new legislations on environmental management and monitoring should be regularly conducted during the construction of the works.

4. Yen Bai City Investment and Construction Project Management Unit will hand over the works to local government/operation and management firm after completion of work items under the sub-project to bring the works into operation as soon as possible.

5. Để Thành phố Yên Bái thực sự trở thành một đô thị xanh, sạch, đẹp, cần có sự hỗ trợ của một số dự án/ công trình khác có liên quan như xây dựng trung tâm thương mại, chợ kết nối thương mại kết hợp công viên cây xanh và những chính sách thân thiện môi trường. Kính đề nghị các cấp chính quyền và các ngành chức năng sớm có kế hoạch thoả đáng. In order for Yen Bai City to become a green, clean and beautiful city, other related projects/works such as construction of commercial center, market – park integrated centers and environment friendly policies are much needed. The central government and line ministries are kindly requested to take this recommendation into consideration.

3. The competent authorities are kindly requested to appraise and approve the Environmental-social management plan to speed up the commencement of the sub-project as the Plan will also serve as basis for environmental management and protection when the sub-project comes into operation.

COMMITMENTS

Given the environmental impacts deriving from the operation of the sub-project and provisions under Law on Environment Protection, Circular, Resolutions, decisions and Ordinances on environmental protection, Safeguard Policy of World Bank

1. Project Owner/PMU and operation and management unit commit to take mitigating measures, carry out the environmental management program and environmental monitoring program as stated under Chapter 6 hereinabove; fulfill the commitments to the community as stated under Chapter 7 herein; comply with general regulations for environmental protection relating to specific phases of the sub-project.

2. Project Owner/PMU and operation and management unit commit to carry out the environmental pollution minimising plans during the operation of the sub-project in accordance with the approved Environmental-social management plan; strictly comply with Vietnam's environmental standards and regulations and environmental protection commitment.

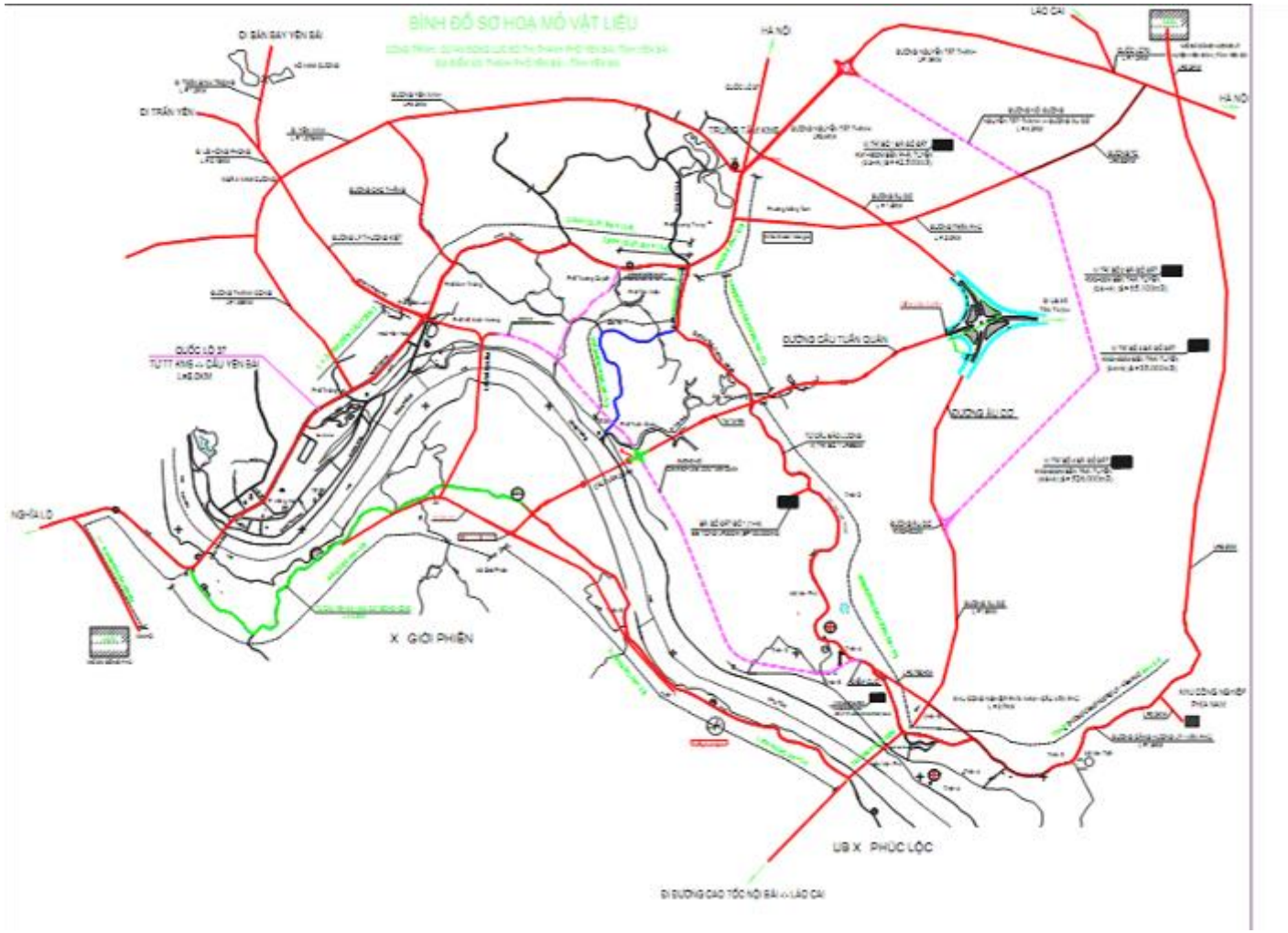
3. Project Owner/PMU and operation and management unit commit to make compensation, support and remedy for environmental pollution in the case of environmental incidents arising from the construction and operation of the sub-project.

REFERENCE

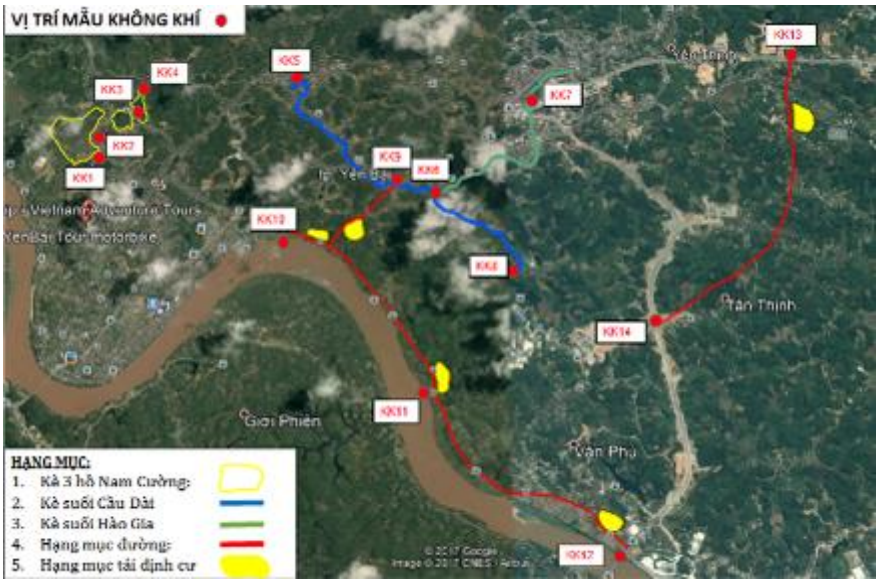
1. World Bank's guide book - Environmental Assessment Sourcebook Volume II - Sectoral Guidelines Environment Department, World Bank, Washington DC, 8/1991. – Quantity of dust arising from the excavation, filling and levelling.
2. Pollution coefficients of WHO (1993) – estimated quantity of dust arising from loading of construction materials
3. WHO: Assesment of Sources of Air, Water and Land Pollution, 1993. – quantity of dust arising from compaction and gathering of materials
4. Cambridge Environment Research Institute: identification of smells based on awareness magnitudes.
5. Statistics of World Health Organisation (WHO), concentrations of pollutants in normal overflowing rainwater.
6. TC 20TCN 4474 – 87 – Standard of water limits used by worker on construction site
7. TC 20TCN33 – 85 – Standard of water limits used for washing and bath by worker on construction site
8. TCXD 33:2006 – Water supply standard and design.
9. ESIA of other projects involing urban upgrating projects, improving in higher education, medium cities development project, Coastal Cities Sanitary Environment Project, Emergency flood disaster reconstruction project...

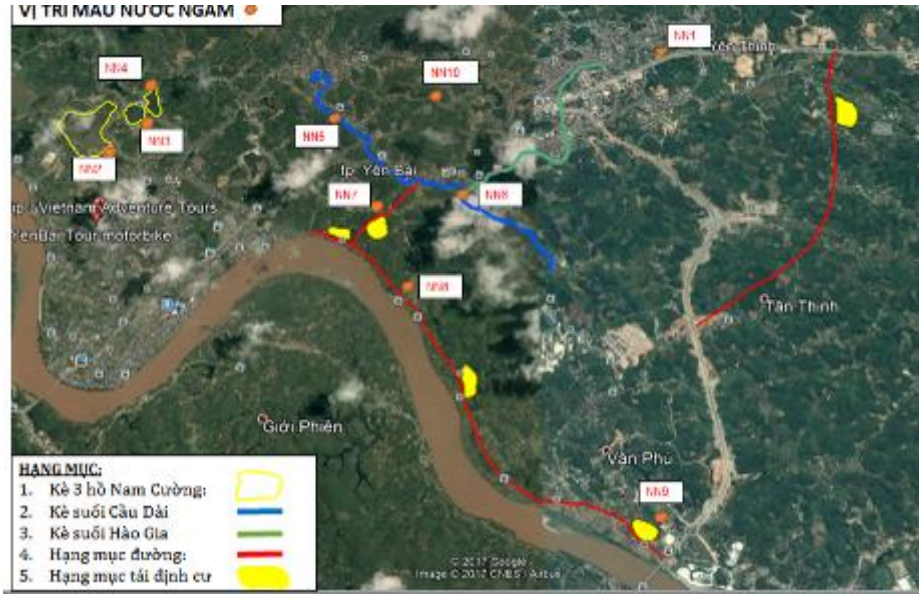
APPENDIX

APPENDIX 1. DIAGRAM OF CONSTRUCTION MATERIAL SUPPLY



APPENDIX 2. DIAGRAM OF ENVIRONMENT MONITORING LOCATIONS






VỊ TRÍ MẪU NƯỚC THẢI
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NT2
NT3
NT4
NT5
NT6
NT7
NT8
NT9
NT10
Tân Thịnh
Giới Phiên
Văn Phú
HẠNG MỤC:
1. Kè 3 hồ Nam Cường:
2. Kè suối Cầu Dài
3. Kè suối Hào Gia
4. Hạng mục đường:
5. Hạng mục tái định cư


VỊ TRÍ MẪU BÙN ĐẤT
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Tân Thịnh
Giới Phiên
Văn Phú
HẠNG MỤC:
1. Kè 3 hồ Nam Cường:
2. Kè suối Cầu Dài
3. Kè suối Hào Gia
4. Hạng mục đường:
5. Hạng mục tái định cư


VỊ TRÍ MẪU TRẦM TÍCH
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Tân Thịnh
Giới Phiên
Văn Phú
HẠNG MỤC:
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2. Kè suối Cầu Dài
3. Kè suối Hào Gia
4. Hạng mục đường:
5. Hạng mục tái định cư

APPENDIX 3. MANAGEMENT PLAN FOR DREDGED SLUDGE

Applicable Objects

Objects of application are domestic agencies, organizations, households and individuals as well as foreign organizations and individuals engaged in activities related to waste.

Owners of waste collection/ transportation facilities/ sludge are organizations and individuals that provide services for waste collection and transportation, including recycling, treatment and recovery of energy from waste/ sludge substances.

General principles

Organizations and individuals engaged in activities of generating dredged sludge and sediment shall have the responsibility to classify, classify, store and register the management of sludge with the State management agency in charge of environment according to law provisions. Existing waste management and must comply with the guidance of the agency in the actual management of the volume of sludge and sludge.

The sludge must be stored, collected and transported to the centralized treatment site as prescribed. It is strictly forbidden to exchange, buy and sell untreated dredged sludge into the environment.

If land has been delimited, the nature of land and sand is determined by the competent authorities without pollutants, no odor and no potential for environmental pollution. is managed according to the following principles:

- For dredged sludge arising during the implementation of the Yen Bai City subproject, shall be treated by accretion of soil for planting or leveling in suitable land areas within the City or for direct utilization. To make materials for the production of construction materials, unburned bricks, low-grade concrete and clean soil at places permitted to be handled in strict compliance with the provisions of law.
- Individuals, organizations and investors are strictly forbidden to carry out the deliberate dumping of sediment into the environment without the guidance of competent authorities.

Organizations and individuals engaged in activities that generate dredged sludge must pay for the collection, transportation and treatment of sludge to units / units having the function of collecting, transporting and disposing, Having enough functions and permits for waste and sludge disposal activities according to the provisions of law.

Dredged sludge management plan

Dredged sludge (from lakes, streams) must be collected, transported, dumped, reused, recycled and handled in accordance with the law. Including:

- Minister of Agriculture and Rural Development regulates the management of dredged sludge from streams and irrigation works.
- Minister of Natural Resources and Environment regulates the management of dredged sludge from lakes and other waters.
- Provincial People's Committee prescribes dumping site, dredged sludge treatment...