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PEOPLE'S COMMITTEE OF HAI DUONG PROVINCE
PEOPLE'S COMMITTEE OF HAI DUONG CITY

DYNAMIC CITIES INTEGRATED DEVELOPMENT PROJECT
SUBPROJECT OF HAI DUONG CITY, HAI DUONG PROVINCE

Final Report

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Hai Duong, March 2018

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Final Report

DYNAMIC CITIES INTEGRATED DEVELOPMENT PROJECT

HAI DUONG CITY SUB-PROJECT
HAI DUONG PROVINCE

PROJECT OWNER
PEOPLE COMMITTEE OF HAI DUONG CITY

CONSULTANT
INTERNATIONAL ENGINEERING CONSULTANT JOINT STOCK COMPANY (INTEC)

Hai Duong, March 2018

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ABBREVIATIONS AND ACRONYMS

DCIDP	Dynamic Cities Integrated Development Project
DONRE	Department of Natural Resource and Environment
DPC	District People's Committee
ESIA	Environmental and Social Impact Assessment
ECOP	Environmental Codes of Practice
EP	Environmental Police
EPA	Environmental Protection Agency
ESMP	Environmental and Social Management Plan
GoV	Government of Vietnam
MONRE	Ministry of Natural Resource and Environment
PMU	Project Management Unit
PPC	Provincial People's Committee
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SA	Social Assessment
WB	The World Bank
T/d	Tones per day
cmd	cubic meters per day
VND	Vietnamese Dong (Vietnamese currency)
USD	United States Dollars, exchange rate 1 USD = 22.750 VND

EXECUTIVE SUMMARY

Project Background and Proposals. The Dynamic City Integrated Development Project (DCIDP) has been proposed to "increase access to improve urban technical infrastructure and capacity building for urban planning and management in the cities of the Project" which is in line with the Vietnam Masterplan for Urban Development (approved by the Prime Minister in 2009). The DCIDP covers five cities and towns including Hai Duong city (Hai Duong province), Tinh Gia, Ky Anh, Thai Nguyen and Yen Bai.

The Hai Duong subproject is comprised of two components, including: (i) Component 1: Improvement of Urban Infrastructure; (ii) Component 2: Technical assistance and investment implementation. The proposed key investments are summarised in the table 1, below:

Table 1: Project's Investment Scope

No	Work item	Project's scope
I	**Component 1: Improvement of Urban Infrastructure**	
1	***Completion of technical infrastructure on Nguyen Luong Bang and Thanh Binh roads***	
1.1	To complete the drainage system on Nguyen Luong Bang road	- To install round culvert system of diameters from D600 to D1,500 on two sides of the road with a total length of L=5.01, construct manholes and restore the road surface; to rehabilitate sidewalk and plant trees along the road.
1.2	To complete the drainage system on Thanh Binh road	- To install round culverts of diameters diameters from D1,000 to D2,000 on two sides of the road with a total length of L=3.84 km; To construct manhole and to recover the road surface; to rehabilitate sidewalk and plant trees along the road.
2	***Rehabilitation of rainwater drainage system in the north of the railway***	
2.1	Rehabilitation of Nghe regulating lake	- To rehabilitate the lake with an area of F=2.4 ha, including: dredging and lining the embankment for the lake with precast reinforced concrete slabs, slope 1:1; and constructing the operation road with width of 3m around the lake.
2.2	Rehabilitation of the ditch system in the north of the National Highway No. 5 (NH5) to convey water to Nghe lake and Binh Han pumping station	- To rehabilitate the ditch system *BxH=600x600-BxH=10000x4000*, a total length of L=4.09km, including: dredging and lining embankment on two ditch banks by precast reinforced concrete slabs, slope 1:1 or construct retaining wall or construct the operation road of 2m wide along two banks of the ditch, depending on terrain condition.
2.3	Rehabilitation of the drainage system in the north of the railway	- To construct the open channels along the tree row between the NH5 and the local road. The channel has a length of 3.6 km, including excavation of the channel, lining with pre-cast concrete slabs. - To construct two drainage pumping stations at two culverts crossing the NH5 to conduct water to Nghe lake and Binh Han pumping station. The two pumping stations has an area of 30 m^2, capacities of 2.7 m^3/s and 1.28m^3/s, respectively. - To drill the pipe at two pumping stations crossing NH5
3	***Lining embankment for T1 canal and constructing new Lo Cuong pumping station***	
3.1	Lining embankment for T1 canal	- L=1.58 km, the work includes dredging and lining the embankment on the 2 banks by precast reinforced

No	Work item	Project's scope
		concrete slabs, slope 1:1. - Constructing the operation road of 3m wide and lighting system along the canal banks.
3.2	Constructing new Lo Cuong pumping station	- Constructing new Lo Cuong pumping station at the adjacent place with Sat river, capacity Q=11 m^3/h.
4	***Lining embankment on two banks of Bach Dang river (from Tam Giang bridge to the dock)***	-Lining the embankment on the two banks of Bach Dang river with a total length L=2.8 km (1.4km each bank) including work item of dredging and lining stone embankment, constructing operation road from 2-4m wide along the embankment.
5	***Constructing the wastewater collection and treatment system in the west of the city***	- Constructing the separate sewer system for rainwater and wastewater, total length of the D300-D600 sewer is 127.1 km long. - Constructing 24 booster pumping stations with capacity from Q= 238 m^3/day to Q=12,000 m^3/day and forced pipeline D300-D600 with L= 1.53 km. - Constructing wastewater treatment plant with capacity Q=12,000 m^3/day by 2025.
II	**Component 2: Technical assistance and investment implementation**	
6	**Technical assistance**	- Supporting the preparation and review of the province and city's plan and strategy with solutions for responding to climate change, green development and for sustainable development. - Supporting the preparation of strategy for public and non-motorized transport development.
7	**Investment implementation**	- Consultant fees during the preparation and implementation of the project such as: consultant service for preparation of Investment policy proposal; consultant service preparation of FS and safeguard instruments; consultant service for survey, detailed design
8	**Other cost**	Cost for clearance of unexploded ordnances, appraisal cost and fee, construction insurance…

An Environmental and Social Assessment and an Environmental and Social Management Plan (ESIA/ESMP, this document) has been prepared to meet the requirements of the World Bank's Safeguard Policies. Public consultations were carried out during the preparation of the draft ESIA. The Project will also comply with applicable Vietnamese environmental legislations. The draft ESIA/ESMP has been disclosed locally in Project area at the end of November 2017 and on the Bank website on 28 November 2017. The main contents of the ESIA/ESMP includes:

Chapter 1: Project Description

Chapter 2: Natural, Social and Economic Conditions

Chapter 3: Environmental and Social Impacts Assessment

Chapter 4: Analysis of Alternatives

Chapter 5: Environmental and Social Mitigation Measures

Chapter 6: Environmental and Social Management Plan

Chapter 7: Public Consultations and Information Disclosure

Chapter 8: Conclusions, Recommendations and Committements

The Hai Duong Project is scheduled to be implemented from 2019 to 2023, with a total investment cost of approximately 78.87 millions USD.

Baseline Conditions

Hai Duong city is the economical, political, social and cultural center of Hai Duong province, which is the central hub of the Northern Key Economic Zone on the northern economic corridor. Hai Duong is a Class II city with total land area of 71.6 km^2, and a population of 231,662 people (As of 31st December 2016) and has 21 administrative units including 17 wards and 4 communes. The DCIDP – Hai Duong city sub-project will be implemented in 10 wards and communes.

Hai Duong city is located in a flat, low-lying terrain, inclining from Northwest to Southeast, from elevation +2.0m to +2.40m and toward +1.5m – 1.0m, or even +0.5m to +0.8m. The city has a diversified system of ponds and lakes connecting with rivers dividing the city into small basins. The main formation is alluvium derived and sedimented from the ancient Red river and Thai Binh River. The weather is governed by tropical monsoon climate. The main water bodies in Hai Duong are Thai Binh and Sat rivers which flow within Hai Duong territory.

The analysis results indicate that air quality of the subproject area is relatively good with the parameters of particulate matters, SO_2, CO, NO_2 lower than the national standards for ambient air quality. The surface water quality in Bach Dang, Sat river, T1 cannal and Nghe lake are containminated with organic substance. Because Bach Dang river, T1 annal and Nghe lake are currently receiving waste and domestic wastewater from households living along the two cannals/rivers' embankments. The soil and sediment sampled at the subproject sites meet the national standards on heavy metal in the soil for residential land. The ecosystems within the direct influence of the subproject are urban and agricultural ecosystems with dominated by rice, shrubs, invasive plants, household livestock such as ducks, dogs, cats. The aquatic species in Bach Dang, Sat river, Nghe lake and T1 cannal are mainly some phytoplankton, zooplankton, and benthic species. There are no endemic aquatic species or species listed in the Red Book in the subproject construction area.

There are some physical cultural resources which are located within the direct area of influence of the subproject including Lo Cuong Temple (30 m from T1 cannal); Han Pagoda (Adjacent to Nghe lake); (Dong Nien temple (35m from Booster pumping station No. 5); Co Hoai temple (30 m from Booster pumping station No. 10); Cam Khuc Pagoda (22 m from Booster pumping station No. 22).

Potential Social and Environmental Impacts and Risks

The Project has been classified as Environmental Category B by the World Bank. The social and environmental potential impacts and risks have been identified and assessed in Chapter 3 of the ESIA. In general, the proposed subproject would bring about significant positive impacts to the participating cities. Local people will be benefited from a healthier and sustainable living environment. Among others, the positive impacts include: (i) improved environmental conditions and urban landscape in many public and residential areas; (ii) increased wastewater collection and treatment; (iii) minimized discharge of untreated wastewater into the environment; (iv) reduction of public health risks associated with water-born diseases and related healthcare cost; (v) reduction of traffic jam or safety risks caused by inundation; (vi) increased the accessibility of local people to nearby areas. Beside the significant positive impacts, the ESIA assessed that there would be also some negative impacts and risks during the pre-construction, construction and operations of the infrastructure provided under the subproject.

Pre-construction Impacts and Risks. In terms of land acquisition and resettlement, 7,691.91 m^2 of land will be acquired, including 668.1 m^2 residential land; 478.81m^2 pond land, 1,545 m^2 canal land under CPC management and 5,000m^2 of landfill. 90 households will be affected of which 80 households will lose land and 18 households will be affected in structures. No households will be relocated. As the sub-project area was subjected to civil wars in the past, there would be the risks that some UXO (unexploded materials) have been left underground in the subproject area.

Construction Impacts and Risks. Most of common construction impacts would be localised, at low to moderate levels, including: increased dust, bad odor, noise and vibration levels, solid waste and hazardous solid waste, surfacewater quality reduction, localized flooding issues, traffic disturbance and traffic safety risks; impact on existing infrastructure; Impact on city landscape and Impacts from risks and incidents. The risks related to labour influx related to the Project have also been considered as low under the subproject. The ESMP also have identified site-specific impacts and risks of each work item where sensitive receptors (such as kindergarten, temple, residential areas etc.) are located or or water quality reduction related to dredged materials.

Operation impacts and Risks. The main social and environmental risks during the operation of water drainage system, embankment of cannal and regular lake are (i) local flooding due to the poor operation and maintenance (ii) embankment subsidence risk during operation; the status of direct waste disposal; Risks from the open channel system. odors control, sludge; health and safety of the workers and the pubic would be the issues that should be considered during the operation phase of the wastewater treatment plant, including wastewater pumping stations.

Mitigation Measures

To address the identified and assessed potential impacts and risks identified in Chapter 3, mitigation measures have been proposed and presented under the Environmental and Social Management Plan (ESMP) presented in Chapter 6.

At Feasibility Study and Engineering stages, engineering and greening solutions were proposed for incorporation into the technical design to address some impacts during operation phase, for examples: The design of the embankment has been calculated on the basis of surveys on hydrologic regimes (flood levels, flow regimes, etc.), topography and geology of the area to ensure the safety and effective operation of the embankment. The treatment method of Food Chain Reactor (FCR) will be applied for the wastewater treatment system. Advantages of FCR are requirement of short distance between residental area and WWT (L=50m); causing bad odor less than other treatment technology; low management cost (using less electric and reducing sludges about 60% comparing with the traditional treatment technology).

For pre-construction impacts and risks, a budget estimated at approximately 1,210,000,000 VNĐ (approximately 53,100 USD) has been proposed for UXO clearance. A Resettlement Action Plan (RAP) has been prepared to address land acquisition impacts of the subproject. An estimated budget at approximately 58 billions VND (about 2.6 millions USD) for land acquisition and compensation, and for livelihood compensation program (detail see RAP).

Description	Quantity	Amount (VNĐ)
I. Land		**19,822,792,900**
1. Residential land	668.1	19,329,700,000
2. Aquacultural land	478.81	43,092,900
3. Landfill	5000	450,000,000
II. Structure		**28,730,954,858**
1. House	3,510	24,611,909,400
2. Fence	1,560	2,161,692,000
3. Yard	960	4,800
4. Breeding facilities	85	234,515,000
5. Compensation for underground electricity (5%)		1,230,595,470
6. Compensation for tap water (2%)		492,238,188
III. Tree		**1,184,000,000**
1. Fruit tree	1,200	780,000,000
2. Timber tree	2,020	404,000,000
Sub-total I		**49,737,747,758**
IV. Assistance		**2,000,120,000**
1. Assistance for life subsistence	90	861,120,000
2. Assistance for business establishment	15	150,000,000
3. Assistance for vulnerable households	2	6,000,000
4. Incentive bonus	90	900,000,000
5. Transportation in the ward	18	63,000,000
Sub-total II		**51,737,867,758**
V. Other cost		
1. Implementation (2%)		1,034,757,355
2. Independent monitoring (2%)		1,034,757,355
3. Contingency (10%)		5,173,786,776
VII. Total		**58,958,369,244**
Rounded		**58,958,000,000**
Exchanged to USD	22,750	**2,591,577**

(Source: RP report, Oct 2017)

The budget for the resettlement is taken from Hai Duong PPC counterpart fund and will be allocated promptly and sufficiently against the resettlement schedule.

The mitigation measures for common construction impacts have been proposed under the form of Environmental Codes of Practices (ECOP, Table 6.1 in the main report) for incorporation into construction bidding documents. For example, the contractors are required to inform local communities at least one month before construction commencement. They must ensure that the trucks must be covered during transportation of construction materials, or drainage and sedimentation traps must be installed to prevent sedimentation in surfacewater sources, ground area to be disturbed must be kept minimal, site protection measures must be applied to manage safety risks for both the workers and local communities, adequate protective cloths and camp facilities must be provided for the workers to use to protect occupational health etc. In addition, site-specific mitigation measures such as installation of sheet piles at deep excavation to prevent land slide risks were also proposed, such measures were presented in the form ready for inclusion into

bidding documents. The site-specific mitigation measures at sensitive-receptors are presented below:

Table 2: Site-specific impacts, risk and mitigation measures at Physical Cultural Resources (PCRs) sensitive-receptors

Name, Picture of Sensitive Receptor, /Distance to construction site	Site-specific Impacts and Risks	Site-specific Mitigation Measures
Sub-component 1.1: Drainage and flood prevention		
Tuberculosis and Lung disease Hospital (Adjoin Thanh Binh road) 	i) Access hinderance to the hospital; (ii) traffic jam at the intersection between the road with the hospital; (iii) safety risk for people	-Inform the hospital management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction -Construction area to be marked with warning signs to prevent and unauthorized people from entering. -Prohibit use of construction methods that cause noise at night - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes when doctors, nurses and patients go to and leave the hopital. - Do not load construction materials within 20m from hospital and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at end of the working day. - Immediately address any issue/problem caused by the construction activities and raised by the hospital
Hai Duong Medi-Tech University Hospital (Adjoin Nguyen Luong Bang road) 	i) Access hinderance to the hospital; (ii) traffic jam at the intersection between the road and the hospital; (iii) safety risk for people	As above

Name, Picture of Sensitive Receptor, /Distance to construction site	Site-specific Impacts and Risks	Site-specific Mitigation Measures
Hai Duong Medical College (Adjoin Nguyen Luong Bang road) 	i) Access hinderance to the colege; (ii) traffic jam at the intersection between the road and the colege; (iii) safety risk for students and teachers. Note: School time: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 every weekday.	Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction Construction area to be marked with warning signs to prevent pupils and unauthorized people from entering. Teachers to be informed of construction operations to keep pupils off the site during their break time. Prohibit use of construction methods that cause noise during school learning hours. Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes when children go to and leave the school. Do not load construction materials within 20m from school and tidy construction materials and stockpiles every working session. Cover the incomplete trenches under construction at end of the working day. Immediately address any issue/problem caused by the construction activities and raised by the schools
Sub-component 1.2: To rehabilitate the rain water drainage system in the north of the railway		
Han pagoda (Cuc Lac)- Adjacent to Nghe lake 	- Noise, dust and vibration from construction activities - Reduce of number of visitors, - Risks of traffic accidents and safety, and - Conflicts between workers and visitors to the pagoda. - It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day	Inform Han Pagoda of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. The contractor shall coordinate with local authorities (leaders of local wards or communes) for agreed schedules of construction activities at sensitive times (e.g., religious festival days). Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. Pile driving activities will not be carried out before 7 am or after 6 pm,

Name, Picture of Sensitive Receptor, /Distance to construction site	Site-specific Impacts and Risks	Site-specific Mitigation Measures
		or at days and hours advised by the local management. Environmental training for the workers includes codes of conducts when working in public areas and sensitive receptors such as pagodas. The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to local people and goers to pagoda. Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the pagodas. Truck drivers shall restrict horning in areas close to the pagoda area Immediately address any issue/problem caused by the construction activities and raised by the pagodas.
Cemetary (Adjacent to Nghe lake) 	- Noise, dust and vibration from construction activities - Reduce of number of visitors, - Risks of traffic accidents and safety, and - Conflicts between workers and visitors to the cemetary.	Inform the cemetary of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. The contractor shall coordinate with local authorities (leaders of local wards or communes) for agreed schedules of construction activities at sensitive times (e.g., religious festival days). Pile driving activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management. Environmental training for the workers includes codes of conducts when working in public areas and the sensitive receptor. The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to local people and goers to cemetary Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the cemetary Truck drivers shall restrict horning in areas close to the pagoda area Immediately address any issue/problem caused by the construction activities and raised by the cemetary.
Sub-component 1.3: T1 canal embankment and construction of new Lo Cuong pumping station		

Name, Picture of Sensitive Receptor, /Distance to construction site	Site-specific Impacts and Risks	Site-specific Mitigation Measures
Lo Cuong temple (30 m from T1 cannal embankment) 	- Hinder access to the temple - Reduce number of visitors - Traffic safety risks - Conflicts between workers and visitors It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day	As mentioned in Han Pagoda as above
Medical station in Tu Minh ward (150 m from T1 cannal embankment) 	Dust, noise and gas emission generated from the transportation trucks Impact on staffs and patients Traffic safety risk	As mentioned in Tuberculosis and Lung disease Hospital as above
Sub-component 1.5: Construction of the wastewater collection system in the west of the city		
Nhi Chau kindergarten (50 m from Booster pumping No.1) 	Dust, noise and gas emission generated from the transportation trucks Impact on teachers and students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday	As mentioned in Hai Duong Medical College as above
Viet Hoa kindergarten Nhi Chau kindergarten (10 m from Booster pumping No.5) 	Dust, noise and gas emission generated from the transportation trucks Impact on teachers and students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday	As mentioned in Hai Duong Medical College as above
Tan Binh kindergarten (1 m from Booster pumping No.16) 	Dust, noise and gas emission generated from the transportation trucks Impact on teachers and students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday	As mentioned in Hai Duong Medical College as above
Tu Minhkindergarten (20 m from	Dust, noise and gas	As mentioned in Hai Duong Medical

Name, Picture of Sensitive Receptor, /Distance to construction site	Site-specific Impacts and Risks	Site-specific Mitigation Measures
Booster pumping No.21) 	emission generated from the transportation trucks Impact on teachers and students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday	College as above
Dong Nien temple (35 m from Booster pumping No.5) 	- Hinder access to the temple - Reduce number of visitors - Traffic safety risks - Conflicts between workers and visitors It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day	As mentioned in Han Pagoda as above
Co Hoai temple (30 m from Booster pumping No.10) 	- Hinder access to the temple - Reduce number of visitors - Traffic safety risks - Conflicts between workers and visitors It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day	As mentioned in Han Pagoda as above
Cam Khuc Pagoda (22 m from Booster pumping No.22) 	- Hinder access to the temple - Reduce number of visitors - Traffic safety risks - Conflicts between workers and visitors It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day	As mentioned in Han Pagoda as above

In the Dredging and Dredged Material Management Plan (DMMP), the dredged material is proposed to be transported and treated at Tu Minh landfill in Viet Hong commune, Thanh Ha district, Hai Duong city or can be partially reused as fertilizer by the households near the project. Baseline data shows that parameters in the sediment samples taken in the project area are all within allowable limits. Leachate from sediment will be returned to the river/lake.

The Workers Code of Conducts were also developed as part of ECOP to address the concerns that may be arisen from labour influx (although quite small). In addition, the ESMP also proposed that training on HIV/AIDs awareness for the workers and

construction supervision teams will also be provided during the implementation of this subproject. The estimated cost for this training is 100,000,000 VND.

Environmental and Social Management Plan (ESMP)

The ESMP proposed an institutional arrangement and identified responsibilities for the implementation of the stakeholders, as below.

Table 3: Management Organization and Responsibilities

Stakeholders	Responsibility
Provincial People's Committee (PPC)	- Overall responsible for environmental and social safeguard implementation and compliance monitoring - Ensure that adequate resources are allocated for safeguard implementation and management
Project Management Unit (PMU) - Project Owner	- The PMU is responsible for monitoring and supervision to ensure that the Project comply with the World Bank Safeguard Policies and Vietnamese legislations: - PMU assign an Environmental Officer (EO) in charge to monitor the implementation and compliance of ESMP and at least a Social and resettlement Officer (EO) to oversee resettlement and compensation issues - Ensure that the mitigation measures proposed in the ESIA are adequately incorporated into relevant project documents such as engineering design, cost estimations, bidding and contractual documents - Ensure that adequate environmental and safety training, monitoring and supervision tasks are included in the Terms of References of the Construction Supervisors - Communicate and coordinate with relevant authorities at central and local levels, with independent monitoring consultants to facilitate public consultation, implementation of mitigation measures and voluntary monitoring - Coordinate with the Construction supervisors to carry out due diligence review of additional sites such as borrow pits and quarries as and when required - Monitor to ensure timely and effective implementation of the ESMP: - Monitor environmental compliance; - Carry out unannounced inspections; - Review periodical reports submitted by the construction supervision consultant (CSC) and IEMC and take follow up actions - Submit periodical safeguard reports to WB and MONRE. - assure all resettlement activities will take place in compliance with this RP. Specifically, PMU will: - Cooperate with PPCs, and relevant local competent agencies to conduct compensation and resettlement. - Organize training and building capacity activities for PPMUs. - Cooperate with PMUs to monitor compensation, resettlement; - Report periodically on resettlement progress to PPC and the WB.
PMU Environmental Staffs (ES)	- The EO will advise the PMU leaders on solutions for environmental issues to ensure the compliance with WB's safeguard polices and regulations stipulated by Vietnamese Government. - The EO will coordinate with the CSC team and the contractors to carry out due diligence review of borrow pits, quarries identified during construction phase and decide whether they are eligible for use in the Project - Coordinate with the Environmental Officer of the Construction Supervision team to carry out environmental due diligence review of borrow pits, quarries, disposal sites as well as any other sites required under the Project

Stakeholders	Responsibility
PMU Social and Resettlement Officer	- The Social and Resettlement Officer in charge will help with solving social and resettlement issues of the Project, supervising the compliance with RP, participate in investigation and solving complaints related to social issues and land acquisition.
Design consultant	- Incorporate mitigation measures in to engineering design, cost estimates, bidding documents and construction contract,
Construction Supervision Consultant/Engineer (CSC/CSE)	- Provide training for contractor's workers on environment, occupational safety, HIV/Aids training - Arrange for environmental quality monitoring and report preparation for submission to relevant government authorities - Monitor and supervise the Contractors to ensure compliance with ESIA/ESMP - Direct the Contractors to carry out corrective measures when excessive pollution or any non-compliant is detected - Carry out due diligence review of additional sites such as borrow pits and quarries as and when required - When detecting any excessive pollution or any non-compliant contractor, the construction supervision consultant shall propose and direct related contractors to implement additional mitigation or corrective measures to address the issues/impacts to satisfactory level. - Propose the PMU to suspend partially or entirely the construction work if a contractor fails to meet the requirements on safety and environmental protection as agreed or stated in the contract. - Prepare and maintain records on complaints and incidents
Independent Monitoring Consultant	- IEMC will, under the contract scope, provide support to PMU to establish and operate an environmental management system, offers suggestions for adjusting and building capacity for relevant agencies during subproject implementation and monitor the CESMP implementation in both construction and operation phases. IEMC will also be responsible to support PMU to prepare monitoring reports on ESMP implementation. - The IEMC will have extensive knowledge and experience in environmental monitoring and auditing to provide independent, objective and professional advice on the environmental performance of the subproject
Contractors	- The contractor will assign Enviromental and Social Staff(s) to carry out Enviromental and Social mitigation measures proposed in ESIA/ESMP. - Based on the approved environmental specifications (ECOP) in the bidding and contractual documents, the Contractor is responsible for establishing a Contractor ESMP (CESMP) for each construction site area, submit the plan to PMU and CSC for review and approval before commencement of construction. In addition, it is required that the Contractor get all permissions for construction (traffic control and diversion, excavation, labor safety, etc. before civil works) following current regulations. - The Contractor is required to appoint a competent individual as the contractor's on-site Safety and Environment Officer (SEO) who will be responsible for monitoring the contractor's compliance with health and safety requirements, the CESMP requirements, and the environmental specifications (ECOP). - Take actions to mitigate all potential negative impacts in line with the objective described in the CESMP. - Actively communicate with local residents and take actions to prevent disturbance during construction. - Ensure that all staff and workers understand the procedure and their tasks in the environmental management program. - Report to the PMU and CSC on any difficulties and their solutions. - Report to local authority and PMU and CSC if environmental accidents occur and coordinate with agencies and keys stakeholders to resolve these issues

Stakeholders	Responsibility
Community	- Community: According to Vietnamese practice, the community has the right and responsibility to routinely monitor environmental performance during construction to ensure that their rights and safety are adequately protected and that the mitigation measures are effectively implemented by contractors and the PMU. If unexpected problems occur, they will report to the CSC and PMU
City People's Committee (CPC)	- Prepare annual land use plan and submit to competent authorities for review and approval of changed land use plan. - Issue Notice of Land Acquisition and direct Town Board for Compensation and Land Acquisition,. - Adjusting or grant a new land use right certificate for the land to be acquired, and for relocated households. - Settle complaints related to land acquisition, compensation, support and resettlement in the district within its jurisdiction. - Approve compensation support and resettlement assessment to be carried out by the City BCLA
City Board for Compensation and Land Acquisition (CBCLA)	- Coordinate with PMU and CPCs to disseminate information and policies on project's policies on compensation and support; - Organize for compensation payment and support to affected people; - Arrange resettlement for relocated households, land acquisition, and handover of acquired land to the construction units; - Lead and coordinate with PMU and CPCs to implement Livelihood Restoration Program; - Assist CPCs to settle complaints concerning land acquisition, compensation and resettlement. - Support CPC in issuance of LURCs for land plot in the resettlement site. - Support the external monitoring consultant for conducting independent resettlement monitoring.
Ward/Commune People's Committee	- Cooperate with CBCLA in arranging compensation payment, resettlement and livelihood restoration implementation; - Provide documents related to the origin of land use of AHH; confirming the eligibility of affected persons and affected assets; - Assist CPC, CBCLA to organize meetings and public consultations; - Resolve complaints at the ward/commune level - as prescribed by the existing law; Assist authorities to resolve land disputes and complaints.

In addition, the ESMP also have proposed an environmental monitoring and supervision program as well as reporting requirements, capacity building training plan, compliance framework and penalty system as detail in Chapter 5. The total estimated costs for ESMP implementation are summarized below.

Table 4: Total estimated costs for ESMP implementation

No.	Items	Unit	Quantity	Unit price (VNĐ)	Total amount (VNĐ)
1	UXO Clearance				1,210,000
2	Mitigation measures implementation	As a part of construction contracts values			
3	Environmental compliance monitoring	As a part of construction supervision contract value			
4	Training on HIV /Aids for the workers, PMU staff	Sites	5	20,000,000	100,000,000
		(as part of construction supervision contract)			
5	Independent monitoring, including:				
	Environmental Monitoring				1,510,830,300

	(three phases)				
	Specialist salary for Independent monitoring				2,720,936,000
	Training on capacity building	Lump sum		100,000,000	100,000,000
6	**Total**				5,541,766,300

Conclusions and Recommendations:

Conclusions :

The "**Dynamic Cities Integrated Development Project – Hai Duong City Sub- Project"** is a improved basic urban infrastructure project of which the main work includes: (i) Completion of technical infrastructure for main roads in the west of the city to facilitate people's transport; rehabilitation of drainage system to prevent urban flooding and inundation; improvement of environmental sanitation and people's living condition; supporting urban sustainable development, green and smart urban centers in responding to climate change. Hai Duong project will help to improve the city's drainage conditions, local flooding and environmental conditions, contributing to the sustainable growth of the city.

The contents of ESIA report comply with the current requirements for environmental impact assessment stipulated by the Vietnamese Government and WB's policies. The report will be one of the key documents to be submitted to State management agencies in charge of the environment to determine the location and scope of the work as a basis for applying for an investment license. In addition, this is also an important document helping the project appraisal and in the negotiation and signing of the loan agreement between the Government of Vietnam and the World Bank.

Environmental impacts:

The environmental impacts were theoretically and empirically assessed with support from the baseline and statistical data as well as experiences from similar WB projects. The impacts are relatively quantified as best as they can be for all three stages of project's preparation, construction and operation and will be further assessed and adjusted during the project implementation in order to mitigate the negative impacts and enhance the positive ones.

The positive impacts of the project include (i) improved environmental conditions and urban landscape in many public and residential areas; (ii) increased wastewater collection and treatment; (iii) minimized discharge of untreated wastewater into the environment; (iv) reduction of public health risks associated with water-born diseases and related healthcare cost; (v) reduction of traffic jam or safety risks caused by inundation; (vi) increased the accessibility of local people to nearby areas.

Most of the impacts during the pre-construction and construction stages are temporary and short-term, taking place in areas around construction sites or on transport routes and at disposal sites. The main impacts during the site preparation relate to the acquisition of land affecting residential land, agriculture land and small areas around fences of some religious facilities and local residents. In the construction phase, impacts from dust, vibration and noise as well as issues of social security and occupational safety are much likely to arise. In addition, the transportation and disposal of dredging sludge will also be an area of concern. However, these can be limited or mitigated to the lowest levels by the implementation of the ESMP.

Subproject construction operations might cause a number of negative impacts on the social life of residents in the Subproject area, by bringing about changes in their living conditions and disturb their daily routines as well as production and economy. Emerging issues might include increase in air pollution and traffic accidents, land subsidence or breakdown of drainage or road system, accumulation of sediments and sludge at manholes or canals among others. Nevertheless, these impacts are short-term and can be mitigated.

Mitigation measures:

Measures to control pollution and limit adverse impacts on environment in the construction and operation phases proposed and recommended in this report. Besides the application of appropriate managerial and technical measures, awareness raising and behavior change communication to local people should be paid attention to help maintain the good environment. All the measures are proven to be feasible and able to meet Vietnamese environmental standards.

The environmental monitoring program will be carried out as soon as the State's approval and the license of subproject construction and operation have been obtained. Monitoring data will be stored and serve as a legal basis for compliance with the Environmental Protection Law of Vietnam as well as the environmental safeguard policies of World Bank. These data will also serve the evaluation of the effectiveness and environmental sustainability of the project.

An environmental and social management plan (ESMP) is in place to ensure the management, monitoring, reporting, preparation and adjustment of measures to minimize environmental pollution during project implementation. The project owner, contractors and project management unit, will be responsible for implementing this plan in cooperation with local state management agencies and authorities.

Public consultations have been conducted to share the project contents, potential environmental impacts and mitigation measures to local residents and concerned stakeholders. So far, the project has been receiving great support from the local communities and authorities.

INTRODUCTION

1. Project Background

Viet Nam has set the goal to have urban development together with complete, modern and environmental-friendly technical infrastructure system. The Prime Minister has approved many important orientations to promote cities development following plans, such as the Masterplan for Vietnam's Urban Development under the Decision No.445/QD-TTg dated 07/04/2009, the National Urban Upgrading Program for the period from 2009 to 2020 under Decision No. 758/QD-TTg dated 08/06/2009, the National Urban Upgrading Program for the period 2012-2020 under the Decision No. 1659/QD-TTg dated 07/11/2012. These are the basis for formation of the country's large urban areas with socio-economic development.

Over the past years, Government of Vietnam with the assistance of the World Bank has implemented a number of urban development projects such as the Vietnam Mekong Delta Region Urban Upgrading project, Da Nang Sustainable City Development project, National Urban Development Program – Northern Mountainous Areas, Medium Cities Development Project, which are bringing great benefits with positive changes in urban landscapes and people's awareness about urban and project management in the participating cities.

In order to implement the masterplans and development policy of the Government, the **Dynamic Cities Integrated Development Project** has been proposed with five cities including: Tinh Gia Town (Thanh Hoa Province), Yen Bai city (Yen Bai Province), Thai Nguyen city (Thai Nguyen Province), Ky Anh town (Ha Tinh province) and Hai Duong city (Hai Duong province). The ***Hai Duong subproject, Hai Duong province*** includes two components:

- Component 1: Improvement of Urban Infrastructure
- Component 2: Technical Assistance and Investment Implementation

Figure 0.1: Location map of DCIDP provinces: Yen Bai, Thai Nguyen, Thanh Hoa, Ha Tinh and Hai Duong

2. Related Projects and Planning

The project will comply with the Modified Master Plan of Hai Duong city to 2030 with a vision to 2050 (Decision 1960/QĐ-UBND – Hai Duong city dated 04 July 2017). The goal set for the year 2030 of this Modified Master Plan is strieving to drive Hai Duong city toward sustainable development with 5 objectives: Industrial city, Healthy city, Creative city, Friendly city and Safe city for living. Therefore, the structural component of the Dynamic Cities Integrated Development Project in Hai Duong province will contribute to the improvement of infrastructure and environmental sanitation. The work items will include: (i) Completion of the infrastructure on Nguyen Luong Bang and Thanh Binh roads; (ii) Rehabilitation of the drainage system in the north of the railway; embankment of T1 canal and construction of the new Lo Cuong pumping station with capacity of 36,000 m^3/day; and (iv) Construction of the wastewater collection sewer and 7 pumping stations as well as construction of wastewater treatment plant with capacity of 12,000m^3/day.

3. Technical and Legal Basis for the Preparation of the ESIA

The project has to follow current legal regulations by the Government of Viet Nam and the Donor related to environmental safeguard. Component 2 of the project is non-structural component which is not expected to cause any environemntal and social risks and impacts; therefore, the report will focus on environmental and social impacts generated by work items in Component 1.

3.1. Vietnamese Legal Documents

The Law on Environmental Protection (LEP) No.55/2014/QH13 was approved by the National Assembly of the Socialist Republic of Vietnam (session XIII) on 23/6/2014 and became effective since 01/01/2015.

The LEP and the Decree No. 18/2015/NĐ-CP) dated 14/2/2015 on Environmental Protection Planning, Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Plan are important legal frameworks for environmental management in Vietnam. The LEP provides legal provisions on environmental protection; measures and resources used for environmental protection purposes; the powers, obligations and responsibilities of agencies, organizations, households and individuals in environmental protection. It regulates the strategic environmental assessment, environmental impact assessment and environmental protection commitment.

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

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

Natural Resources and Environment shall manage the training and issuance of Certificates in consultancy of ESIA.

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

In addtion to the LEP the following regulations apply to the subproject:

- Law on Construction No.50/2014/QH13 passed by National Assembly Session XIII of the Socialist Republic of Vietnam on 18 June 2014 and took effect on 01/01/2015;
- The Law on modification and amendments of a number of articles of the Law on Inland Waterway Navigation No. 48/2014/QH13 passed by the National Assembly Session XIII of the Socialist Republic of Vietnam, on 17 June 2014;
- Land Law No. 45/2013/QH13 of the National Assembly of Vietnam dated November 29, 2013, taking effect since 01/7/2014.
- Law on Water Resources No. 17/2012/QH13 of the National Assembly of Vietnam dated June 21, 2012
- Labor Code 10/2012/QH13 dated 18/06/2012 approved by Socialist Republic of Vietnam National Assembly Session XIII dated 18/06/2012;
- Law on Urban planning No. 30/2009/QH12 approved by Socialist Republic of Vietnam National Assembly Session XII dated 17/06/2009;
- Law on Biodiversity No. 20/2008/QH12 of the National Assembly of Vietnam dated November 13, 2008
- Law on Chemical No.06/2007/QH127 approved by Socialist Republic of Vietnam National Assembly Session XII dated 21/11/2007;
- Law on modification and amendments of some articles of Law on Fire protection No.40/2013/QH13 approved by Socialist Republic of Vietnam National Assembly Session XIII dated 22/11/2013.
- The Law on Road Transport No. 23/2008/QH12 approved by Vietnam National Assembly Session XII on 13/11/2008.
- Law on Standard and technical regulations No.68/2006/QH11 approved by Socialist Republic of Vietnam National Assembly session XI on 29/6/2006;
- Law on Inland Waterway Transport No. 23/2004/QH11 approved by the National Assembly Session XI of the Socialist Republic of Vietnam dated June 15, 2004;
- The Law on People's Health protection No. 21/LCT/HDNN8 approved on June 30, 1989 by the National Assembly Session VIII of the Socialist Republic of Vietnam.
- Decree 59/2015/ND-CP dated 18/6/2015 by the Government on management of construction investment projects;
- Decree No. 18/2015/ND-CP dated February 14, 2015 by 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 by the Government detailing the implementation of a number of articles of the Law on Environmental Protection;
- Decree No.38/2015/NĐ-CP dated 24/4/2015 by the Government on waste management;
- Decree No.42/2017/NĐ-CP dated April 05, 2017 by the Government on amending and supplementing some articles of Decree No. 59/2015/NĐ-CP dated 18/06/2015 by the Government on management of constructin investment works;
- Decree No.43/2014/ND-CP dated May 15, 2014 by 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 by the Government providing regulations on land prices.
- Decree No.45/2014/NĐ-CP dated 15/5/2014 by the Government on land use levy;
- Decree No 46/2014/NĐ-CP dated 15/5/2014 by the Government on collection of land rent and water surfae rent fee;
- Decree No.47/2014/ND-CP dated 15 May 2014 by the Government on compensation, support, and resettlement when land acquisition is required by the State.
- Decree 80/2014/ND-CP dated 06/8/2014 by the Government on water drainage and wastewater treatment;
- Decree No.155/2016/ND-CP dated 18/11/2016 by the Government on the penalties for administrative violations against the law on environmental protection
- Decree No.154/2016/ND-CP dated 16/11/2016 by the Government on environmental protection charges for wastewater;
- Decree No. 38/2015/ND-CP dated 24 April 2015 issued by the Government on solid waste management;
- Decree No. 149/2004/ND-CP dated 27 July 2004 regulating the licensing of water resource exploration, exploitation and use, and discharge of wastewater into water sources.
- Decree No.38/2011/ND-CP by the Government amending and supplementing a number of articles on administrative procedures of Decree No. 181/2004/ND-CP dated October 29, 2004, Decree No. 149/2004/ND-CP dated July 27, 2004 and Decree No. 160/2005/ND-CP dated December 27, 2005.
- 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. 32/2015/TT-BTNMT dated July 24, 2015 of the Ministry of Transport regulating environmental protection in the development of transport infrastructure;
- Circular No. 36/2015/TT-BTNMT dated 30 June 2015 on the management of hazardous waste;
- Circular No. 32/2013/TT-BTNMT dated 25/10/2013 of MONRE on the promulgation of national technical regulations on environment;
- Circular 21/2012/TT-BTNMT dated 19/12/2012 regulating quality assurance and quality control in environmental monitoring;
- 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. 22/2010/TT-BXD dated 03/12/2010 of Ministry of construction providing labor safety in construction
- Circular No. 16/2009/BTNMT and 25/2009/BTNMT of the MONRE on promulgation of Vietnam National Standards;
- Circular 02/2009/TT-BTNMT dated March 19, 2009 of the Ministry of Natural Resources and Environment on the regulation on evaluation of water source to receive wastewater;
- Circular No. 10/2007/TT-BTNMT dated October 22, 2007 guiding for Quality Assurance and Quality Control in Environmental Monitoring;
- Decision No. 16/2008/QĐ-BTNMT dated 31/12/2008 of the Ministry of Natural Resources and Environment on promulgation of national technical regulations on environment;
- Decision No. 22/2006/QD-BTNMT dated 18/12/2006 of the Ministry of Natural Resources and Environment mandating the application of Vietnam standards on environment

- ***Applied Standards and Codes:***

Preparation of the ESIA applies following current National technical regulations (QCVN):

- *Water quality:*
- QCVN 01:2009/BYT: National technical regulation on drinking water quality.
- QCVN 08-MT:2015/BTNMT– National technical regulation on surface water quality;
- QCVN 09-MT 2015/BTNMT– National technical regulation on ground water quality.
- QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater.
- QCVN 40:2011/BTNMT: National technical regulation on industrial wastewater.
- *Air quality*
- QCVN 05:2013/BTNMT: National technical regulation on ambient air quality.
- QCVN 06:2009/BTNMT: National technical regulation on hazardous substances in ambient air.
- TCVN 6438:2005 - Road vehicles –Maximum allowable limits of gas emission
- *Soil quality and sediment:*
- QCVN 03-MT:2015/BTNTM - National technical regulation on the allowable limits of heavy metals in the soils.
- QCVN 15:2008/BTNMT: National technical regulation on the pesticide residues in the soils.
- QCVN 43:2012/BTNMT - National technical regulation on sediment quality in fresh water areas.
- *Noise and vibration:*
- QCVN 26:2010/BTNMT: National technical regulation on noise.
- TCVN 5948:1999 - Acoustic - Noise emitted by accelerating road vehicles - Permitted maximum noise level.
- QCVN 27:2010/BTNMT: National technical regulation on vibration.
- *Water drainage and supply:*
- TCVN 7957:2008 - Drainage and sewerage - External Networks and Facilities - Design Standard
- TCXDVN 33:2006 - Water Supply - Distribution System and Facilities.
- *Safety and occupational health:*

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

- *Legal documents related to the project:*
- Decision No. 758/QD-Ttg dated June 8, 2009 of the Prime Minister approving the national program on the upgrading of urban centers during 2009-2020;
- Decision No. 1659/QD-Ttg dated November 7, 2012 of the Prime Minister approving the national development program on the upgrading of urban centers during 2012-2020;
- Decision No. 445/QD-Ttg dated April 7, 2009 of the Prime Minister on approving the modification of the master plan for development of Vietnam's urban system by 2025 and vision to 2050;
- Decision No. 2623/QD-TTg dated December 31, 2013 of the Prime Minister on approval of the scheme "Vietnam's urban development for response to climate change in 2013-2020 period";
- Decision No. 403/QD-TTg dated 2014 of the Prime Minister on approval for the national action plan on green growth;

- Decision No. 1810/QD-TTg dated October 4, 2013 of the Prime Minister on approving the orientation and criteria for using WB's capital in 2014-2018 period and in the following years;

3.2. World Bank's Environmental and Social Safeguard policies

The environmental and social screening for the subproject according to the criteria defined by the Bank's safeguards policies has been carried out, and the result shows that the WB policies on Environmental Assessment (OP/BP 4.01)[1]; Natural Habitats (OP/BP 4.04)[2]; Physical Cultural Resources (OP/BP 4.11)[3]; and Involuntary Resettlement (OP/BP 4.12)[4] are triggered for this subproject. The subproject has also to comply with the WB's requirements on public consultation and disclosure of information required by the relevant safeguard policies and in accordance with the Bank's Policy on Access to Information. The implementation of the policy on OP/BP 4.12 is addressed in the Resettlement Policy Framework (RPF) of the project and the Resettlement Action Plan (RAP) of this subproject. The environmental and social screening and the detailed ESIA confirmed that the proposed subproject is classified as Category B because of its potential moderate adverse environmental and social impacts.

Natural habitats (OP/BP 4.04)

The subproject will not impact any protected area nor will it affect important/endangered flora or fauna species or biodiversity areas of high value. The environmental and social screening and scoping of the subproject confirmed that Bach Dang and Sat rivers, natural rivers that provide habitats for aquatic species. Construction and operation of the embankments would have some potential adverse impacts on natural habitats of the rivers, including loss of benthic habitats and disturbance of benthic organisms. Impacts and mitigation measures have been included in the subproject ESIA and ESMP to address these impacts.

Physical cultural resources (OP/BP 4.11)

The subproject does not necessitate relocation of physical cultural resources (PCRs) such as temples and pagodas, religious/spiritual and cultural sites. This policy is triggered as the subproject civil works will have the potential impacts on these PCRs. Since the project includes dredging and excavation activities, which may result in chance finds, a chance finds procedure has been included in the subproject ESMP.

World Bank Group Environmental, Health, and Safety Guidelines[5]

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

[1]Full treatment of OP/BP 4.01 can be found at the Bank website:
https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1565&ver=current
[2]Full description of OP/BP 4.04 is available at
https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1567&ver=current

[3]Full treatment of OP/BP 4.11 can be found at the Bank website:
https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1571&ver=current
[4]Detailed description of OP/BP 4.12 is available at the Bank website:
https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=1572&ver=current
[5]The EHS Guidelines can be consulted at www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines.

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.

4. ESIA Implementation Arrangement

The subproject owner – Hai Duong City Project Management Unit has contracted International Engineering Consultant Joint-stock company (INTEC) to prepare the Environmental and Social Impact Assessment report for Hai Duong city subproject in 2017. The ESIA team members are presented in Table 0.1 as follows.

Table 0.1: List of ESIA team members

No	Full name	Education background	Involvement in ESIA preparation
1	Cao Thi Thu Huong	Environmental Science M.Sc	ESIA Team leader, main task of compiling the ESIA and writing Chapter 3 and Chapter 5
2	Le Thi Thanh Nhan	Urban environment M.Sc	In charge of content related to geological condition, evaluate impacts related to geological and topographical conditions, propose mitigation measures.
3	Pham Thi Quynh	Environmental Science M.Sc	Write Chapter 4
4	Dang Van Quynh	Environmental Engineer	Conduct public consultation and write Chapter 6
5	Le Thi Phuong Khanh	Environmental Engineer	Write Chapter 1 and Chapter 2
6	Tran Thi Ngoc	Bachelor degree in Sciology	Surveying team leader, conduct public consultations, write content related to local existing economic condition and affected households.

5. Methods for Environmental and Social Impacts Assessment

5.1. Method for Environmental Impact Assessment

Field research method: survey and research the existing status of environmental resources. Study and select locations, parameters, methods of monitoring and sampling soil, sediment, surface water, groundwater, wastewater, and air within the project area.

Sociological Investigation and Public Consultation: This is a participatory method for assessing stakeholder engagement and community involvement in project implementation. To commence public consultation, Consultant will organize public consultation meetings and group discussions in all areas where the project's construction are carried out, ensuring that there are presence of all representatives of directly affected people, indirectly affected people, the management agency; participants in the project construction, other organizations and individuals, etc. The consultations are conducted twice:

- First time: To determine the scope of impact, introduce the project, preliminarily evaluate the environmental impact of the project activities, ask for comments on mitigation measures and identify unforseen environmental issues in the project area.
- Second time: To complete the draft ESIA report: To report and discuss ESIA results and to collect feedback and agree on the results of the environmental impact assessment of the project.

During consultation process, Consultant informs people about possible negative environmental impacts during project implementation, proposes mitigation measures to mitigate those effects. Governments and people in the affected area will provide comments on the environmental issues raised and mitigation measures to be taken.

Statistical method: To collect, process and analyze meteorological, hydrological and environmental data for many years in the project area.

Inheritance method: To inherit the research results of the relevant projects.

Expert method: the consultant has participated in and held meetings and discussions to collect comments and proposal on mitigation measures for negative impacts of the project with environmental experts, soociologist, ...

Inheritance method: To inherit the research results of the relevant projects.

Expert method: the consultant has participated in and held meetings and discussions to collect comments and proposal on mitigation measures for negative impacts of the project with environmental experts, soociologist, ...

Synthetic and analysis method: To analyse and synthesize project impacts on natural environment and socio-economic condition in the project area.

Rapid assessment method: is the assessment method based on emission factor. The rapid assessment method is at high efficiency in determining the pollutant concentration and emissions from the use of machinery and the operation of the material transportation vehicles; concentration of water pollution caused by wastewater generated from daily activities of workers during construction of the project; Water pollution due to operation of the works during project operation. With the rapid assessment method, it is able to forecast environmental impact of the pollution sources and to forecast the amount of pollutant discharge from the source.

Comparing method: To evaluate the impacts by comparing the results of measurement, analysis and calculation of the predicted concentration of pollutants due to the project's activities with the allowable value in Vietnam National standards on soil quality, water, noise, air quality and sectoral standards approved by Ministry of Health, Ministry of Construction.

Matrix Method: A matrix is made up by comparing every activity of the project with each parameter or environmental component to assess cause and effect relationship. The matrix method is very valuable for determining the impact of the project and providing a summary form of impact assessment. This is a simple, easy-to-use method that does not require a lot of environmental data, but can clearly analyze a variety of activities on the same element. Using the environmental matrix method can clearly see the relationship between development and the environment.

Monitoring, sampling and analysing method of the baseline environment: Based on the project activities as well as the process of surveying the actual area of the project, the report carries out monitoring and sampling for analyzing existing status of the baseline environment of the project area to form the rationale for proposing mitigation measures as well as environmental management and monitoring plans when the project is implemented. The environmental components selected for monitoring and sampling include:

Environmental monitoring of soil, surface water and groundwater is carried out in accordance with the following guidelines/standards:

Ambient air monitoring: Circular 28/2011/TT-BTNMT regulates the monitoring process for surrounding ambient air and noise.

Surface water and sediment monitoring: Circular No. 29/2011/TT-BTNMT regulates the technical process of surface water monitoring.

Underground water monitoring: Circular No. 30/2011/TT-BTNMT regulates the technical process of monitoring underground water environment.

Soil environment monitoring: Circular No. 33/2011/TT-BTNMT regulates the technical process for soil monitoring procedures.

The samples are taken at the site, stored and brought to the standard laboratory for analysis of specific environmental parameters. The analysing methods are applied in accordance with the standards/regulations issued by Vietnam.

5.2. Method for Social Impact Assessment

Data surveying and collecting

After the mentioned screening process, a framework and surveying method will be discussed to determine the appropriate sample size, technique/method of data collection. Two main survey techniques are selected, including: (i) using sample forms for the local authorities of the project wards/communes; (ii) surveying for analyzing socio-economic information of households.

Secondary data collection

Information and data related to the project are collected from the Development Project Management Unit and from other socio-economic analyzing sources such as the Statistical Yearbook of Hai Duong province, Socio-economic conditions of the province/district/commune and poverty analysis related to ethnic minority groups.

Quantitative research method

A socio-economic survey is conducted to document the personal profile of people in the project area, relating to affected households and beneficiaries (or both). The socio-economic survey was conducted in October 2017.

Qualitative research method

Qualitative research is conducted in the form of in-depth interviews with key informants including: (a) head of residential group/village, (b) leader of commune/ward People's Committee, (c) households in the project area and (d) affected households and beneficiary households. The purpose of the in-depth interviews is to collect ideas and desires of people in the project area in order to provide appropriate solutions to resolve potential conflicts and identify measures to mitigate the negative impacts of the project. .

Public consultation and disclosure of information

Public consultation is used to help identify opportunities and risks, improved subproject design and implementation, and increase subproject ownership and sustainability. Public consultation is specifically required by the World Bank’s environmental and social safeguard policies. A meaningful public consultation will be used. This is a two-way process in which beneficiaries provide advice and input on the design of the proposed subproject that affect their lives and environment, promotes dialogue between governments, communities, NGOs and implementing agencies to discuss all aspects of the proposed subproject. The feedbacks from consultation will be incorporated into the subproject ESIA and design.

Those affected by the subproject include those resettled and those in the nearby communities affected by subproject impacts, intended beneficiaries of the subproject, key interest groups – depends upon the project, local NGOs/Mass organizations, including women’s unions, local, state and central governments, other donor and development agencies, and other stakeholders.

Disclosure of the subproject information including the subproject safeguards and instruments will allows the public access to information on environmental and social

aspects of the subprojects. Disclosure is mandated by policies for the WB's Environmental Assessment, Involuntary Resettlement, and Indigenous Peoples. The subproject safeguards and instruments will be disclosed in country and in local languages and at the World Bank Infoshop, like all consultations, it is an ongoing process during the subproject preparation and supervision process.

CHAPTER 1. PROJECT DESCRIPTION

1.1. General Information

Project's name in Vietnamese: Dự án phát triển tổng hợp các đô thị động lực – thành phố Hải Dương, tỉnh Hải Dương

Project's name in English: **Dynamic Cities Integrated Development Project (DCIDP)**

Hai Duong Subproject

Donor:	The World Bank
Executive Agency:	Hai Duong Provincial People's Committee
Project's owner:	Hai Duong City People's Committee Address: No.106, Tran Hung Dao street, Hai Duong city, Hai Duong Province Email: haiduongcity@haiduong.gov.vn
Project's proposing Agency:	Hai Duong City People's Committee

Address: No.106, Tran Hung Dao street, Hai Duong city, Hai Duong Province

The project includes two components:

Component 1: Improvement of Urban Infrastructure
Component 2: Technical Assistance and Investment Implementation

Project implementation time: 5 years (From 2019 to 2023)

Component 2 of the project is the non-structural component so the report will focus on environmental and social impacts generated by work items in Component 1.

1.1.1. Project Objectives

1.1.1.1.General objectives

To increase the accessibility to the improved basic urban infrastructure and to improve urban planning and management capacity in the project cities;

1.1.1.2.Specific objectives

- To complete technical infrastructure for main roads in the west of the city to facilitate people's transport;
- To rehabilitate drainage system to prevent urban flooding and inundation;
- To improve environmental sanitation and improve people's living condition;
- To support urban sustainable development, green and smart urban centers in responding to climate change.

1.1.2. Project Location

The project will be implemented on 10 wards namely: Cam Thuong, Binh Han, Ngoc Chau, Nhi Chau, Quang Trung, Tran Hung Dao, Tran Phu, Thanh Binh, Tan Binh and Viet Hoa with land area of 31.1km^2 and bring direct benefits to 123,752 people. The project location is indicated in Figure 1-1.

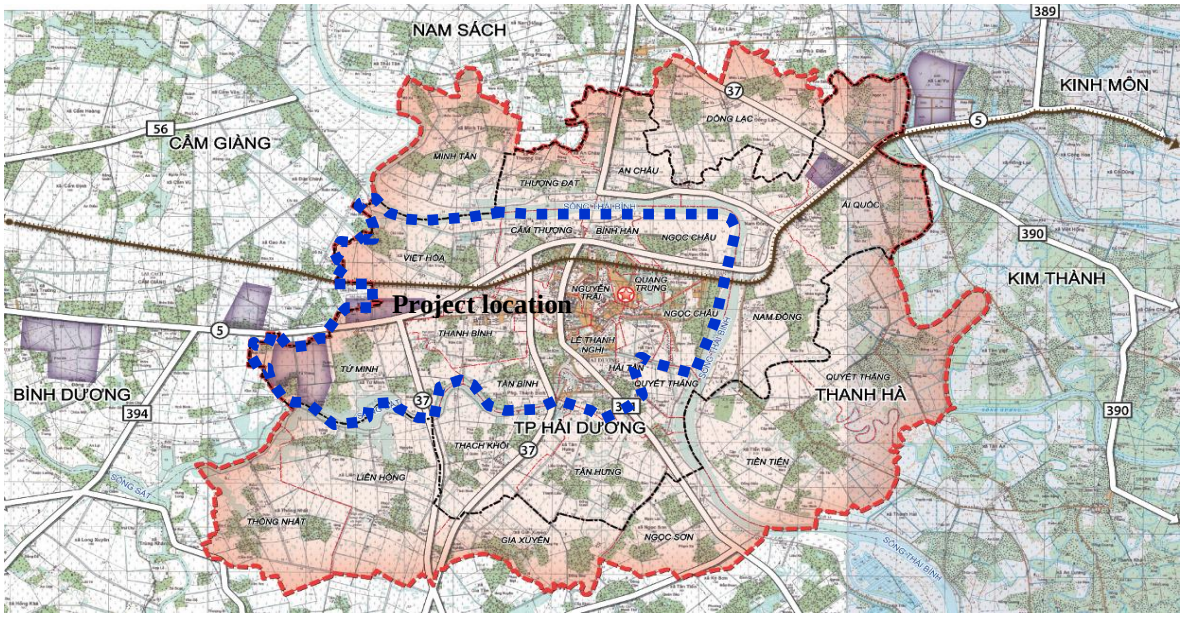


Figure 1.1: Project Location on Hai Duong City Map

1.2. Scope of Investment

1.2.1. Project's Investment Scope

General information on the project's investment scope is presented in following table.

Table 1.1: Project's Investment Scope

No	Work item	Project's scope
I	**Component 1: Improvement of Urban Infrastructure**	
1	***Completion of technical infrastructure on Nguyen Luong Bang and Thanh Binh roads***	
1.1	To complete the drainage system on Nguyen Luong Bang road	- To install round culvert system of diameters from D600 to D1,500 on two sides of the road with a total length of L=5.01, construct manholes and restore the road surface; to rehabilitate sidewalk and plant trees along the road.
1.2	To complete the drainage system on Thanh Binh road	- To install round culverts of diameters from D1,000 to D2,000 on two sides of the road with a total length of L=3.84km; To construct manhole and to recover the road surface; to rehabilitate sidewalk and plant trees along the road.
2	***Rehabilitation of rainwater drainage system in the north of the railway***	
2.1	Rehabilitation of Nghe regulating lake	- To rehabilitate the lake with an area of F=2.4 ha, including: dredging and lining the embankment for the lake with precast reinforced concrete slabs, slope 1:1; and constructing the operation road with width of 3m around the lake.
2.2	Rehabilitation of the ditch system in the north of the National Highway No. 5 (NH5) to convey water to Nghe lake and Binh Han pumping station	- To rehabilitate the ditch system *BxH=600x600-BxH=10000x4000*, a total length of L=4.09km, including: dredging and lining embankment on two ditch banks by precast reinforced concrete slabs, slope 1:1 or construct retaining wall or construct the operation road of 2m wide along two banks of the ditch, depending on terrain condition.
2.3	Rehabilitation of the drainage system in the north of the railway	- To construct the open channels along the tree row between the NH5 and the local road. The channel has a length of 3.6 km, including excavation of the channel,

No	Work item	Project's scope
		lining with pre-cast concrete slabs. - To construct two drainage pumping stations at two culverts crossing the NH5 to conduct water to Nghe lake and Binh Han pumping station. The two pumping stations has an area of 30 m^2, capacities of 2.7 m^3/s and 1.28m^3/s, respectively. - To drill the pipe at two pumping stations crossing NH5
3	***Lining embankment for T1 canal and constructing new Lo Cuong pumping station***	
3.1	Lining embankment for T1 canal	- L=1.58 km, the work includes dredging and lining the embankment on the 2 banks by precast reinforced concrete slabs, slope 1:1. - Constructing the operation road of 3m wide and lighting system along the canal banks.
3.2	Constructing new Lo Cuong pumping station	- Constructing new Lo Cuong pumping station at the adjacent place with Sat river, capacity Q=11 m^3/h.
4	***Lining embankment on two banks of Bach Dang river (from Tam Giang bridge to the dock)***	- Lining the embankment on the two banks of Bach Dang river with a total length L=2.8 km (1.4km each bank) including work item of dredging and lining stone embankment, constructing operation road from 2-4m wide along the embankment.
5	***Constructing the wastewater collection and treatment system in the west of the city***	- Constructing the separate sewer system for rainwater and wastewater, total length of the D300-D600 sewer is 127.1 km long. - Constructing 24 booster pumping stations with capacity from Q= 238 m^3/day to Q=12,000 m^3/day and forced pipeline D300-D600 with L= 1.53 km. - Constructing wastewater treatment plant with capacity Q=12,000 m^3/day by 2025.
II	**Component 2: Technical assistance and investment implementation**	
6	***Technical assistance***	- Supporting the preparation and review of the province and city's plan and strategy with solutions for responding to climate change, green development and for sustainable development. - Supporting the preparation of strategy for public and non-motorized transport development.
7	***Investment implementation***	- Consultant fees during the preparation and implementation of the project such as: consultant service for preparation of Investment policy proposal; consultant service preparation of FS and safeguard instruments; consultant service for survey, detailed design
8	***Other cost***	- Cost for clearance of unexploded ordnances, appraisal cost and fee, construction insurance…

The locations of each work item are provided in Figure 1-2 below:

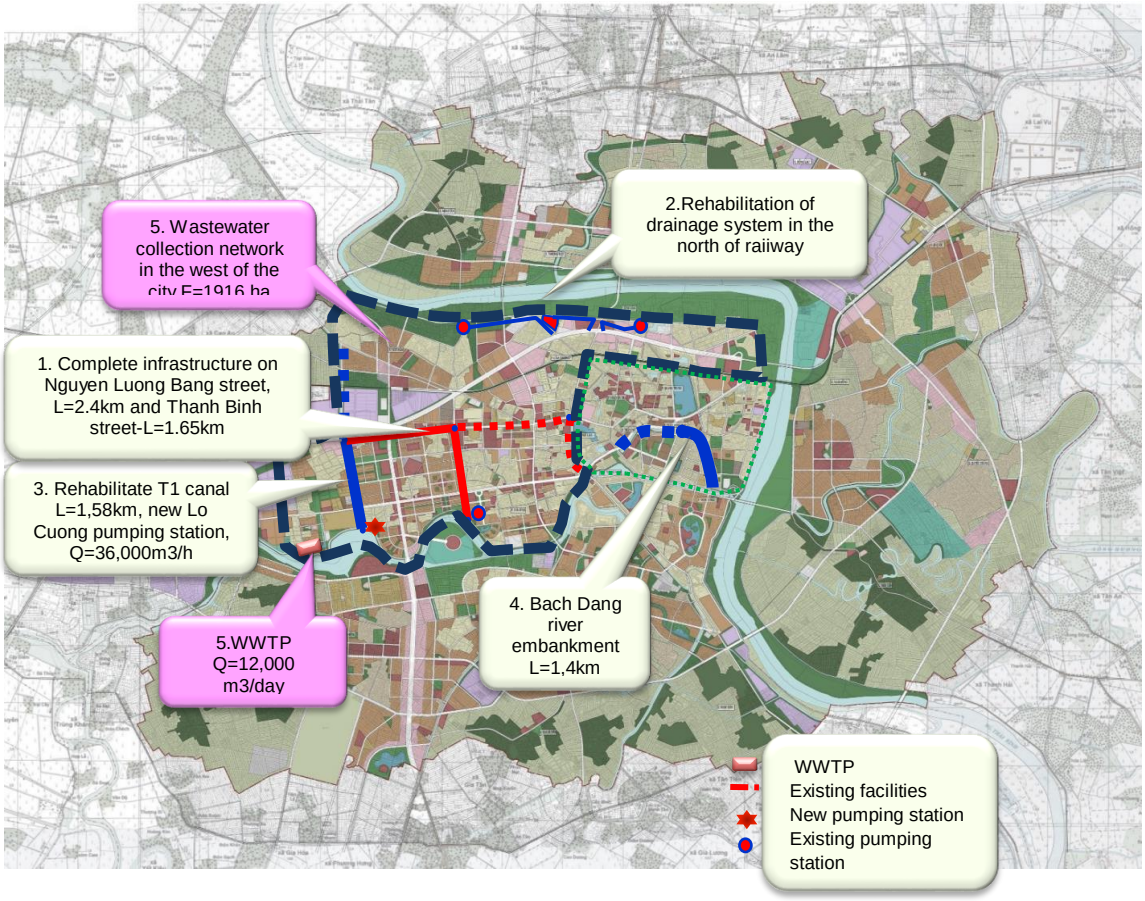


Figure 1.2: Layout of Work Item Locations in the Project Area

1.2.2. Details of Project's Structural Component

❖ **Component 1: Improvement of Urban Infrastructure**

(1) Construction of technical infrastructure on Nguyen Luong Bang and Thanh Binh roads:

To complete technical infrastructure on Nguyen Luong Bang road (from Vu Huu – Nguyen Luong Bang intersection to T1 canal):

Construction of a reinforced concrete drainage system D600-D1500 mm on two sides of the road, L=5.01 km. The drainage system will be laid under the road bed while maholes and runoff water pits will be arranged in parallel with the existing drainage system. Thus, there will be two parallel drainage systems on the same route (the new and the existing one) which will support each other for local drainage. The typical cross section design of the technical infrastructure on Nguyen Luong Bang Road is illustrated in Figure 1.3 below.

The new drainage system has two main drainage directions:

+ Direction 1: For collection of rainwater from Nguyen Luong Bang road from Dong Do Limited company and draining to T1 canal. This section is about 1,500m.

+ Direction 2: The remaining section is for collection of rainwater from Dong Do limited company which is located along the Nguyen Luong Bang road to Vu Huu- Nguyen Luong Bang 4-way intersection with a length of about 900m, collecting and draining waterto Thanh Binh road toward Thanh Binh B pumping station.

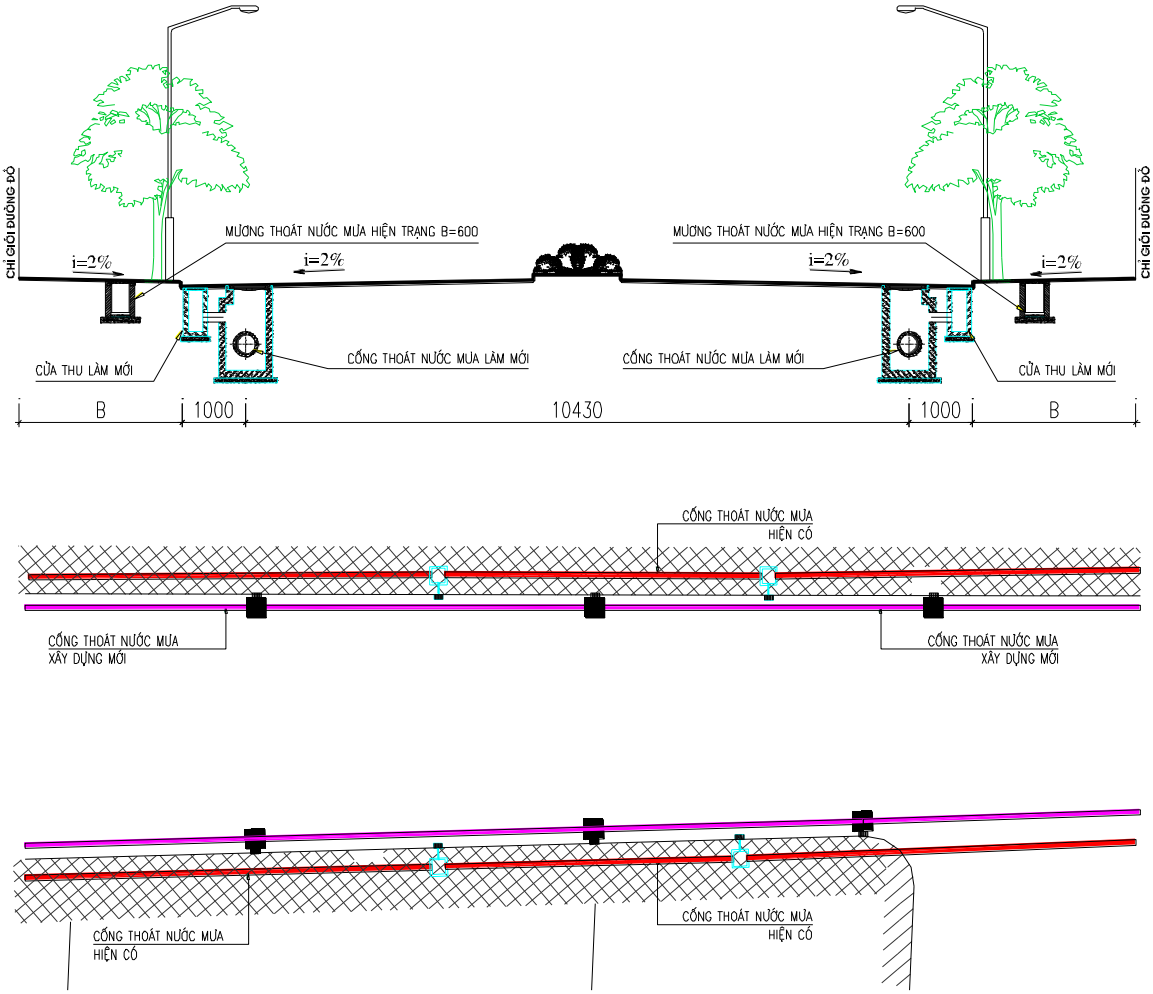


Figure 1.3 : Typical Cross Section of Technical Infrastructure on Nguyen Luong Bang Road

To complete the drainage system on Thanh Binh road (from Nguyen Luong Bang road to Thanh Binh B pumping station) :

Arrangement of the drainage system on Thanh Binh road is similar to the arrangement on Nguyen Luong Bang road where the new drainage will be laid under roadbed because the two roads have same structure. There are already technical infrastructure including water supply, lighting system, optical cable line, drainage system on the sidewalk of 5m; therefore, the sidewalk will no longer accommodate the laying of another drainage system on the sidewalk without destroying the existing system which will still perform well despite of its small section.

Constructing a reinforced concrete system along the road sides, with diameter D1,000-2,000, L = 3.84km. The beginning section will be connected to the drainage system on the Nguyen Luong Bang road and the end point will be connected to the water conduit channel in Thanh Binh pumping station.

(2) Rehabilitation of rainwater drainage system in the north of the railway

❖ *To rehabilitate Nghe regular lake*

+ To rehabilitate Nghe lake to serve as a balancing lake with an area of 2.4 ha. The existing lake area is 3.1ha. The rehabilitation will include dredging the lake from the existing depth of around 0.5m to an expected depth of 4.0m; lining the embankment by precast concrete slabs, slope 1:1, management road around the lake B =3m and technical

infrastructure including lighting system, side drains B=400, wastewater sewer UPVC D200 around the lake. The rehabilitated area of the lake needs to be outside the dyke corridor, and thus only 2.4ha will be rehabilitated instead of the existing 3.1ha.

- *To rehabilitate the drainage system in the North of the railway (Catchment area from NH5 to Thai Binh river)*

+ To rehabilitate the dith system BxH=600x600 – BxH=10000x4000 conducting water from the catchment area in the north of NH5 to Nghe lake, Binh Han pumping station with total length L=4.09km, including dredging work. The construction shape for the ditch can be vertical reinforcement concrete shape or trapezoid lined with reinforced concrete slabs with slope 1:1.

- *To rehabilitate the drainage system in the north of the railway (the catchment area between Ha Noi- Hai Phong railway and NH5):*

+To construct the ditch system: one open ditch BxH =800x800 – BxH=2000x2000 along the NH5 with a length L= 3.60 km. The ditch will contain two sections divided by slope terrain.

+ *Section 1:* From the intersection Nguyen Thi Due –NH5 to Dien Bien Phu-NH5 intersection, L = 2.4km. Drainage system will collect water from the two points to drain to a submerged pumping station which will be constructed on a catchment area of 71.22ha. The submerged pumping station will have a capacity of Q= 2.7 m^3/s, construction area of 30m^2 without station house, using 5 submerged pumps (4 operate, 1 backup), Q=2,500m^3/h for each pump, H =10m, pumping water via the cross culvert of the existing NH5 and connecting to the existing drainage system of Nghe Lake;

+ *Section 2:* From Dien Bien Phu –NH5 intersection to NH5-Thanh Nien intersection, L=1.2km, collecting water from the two points to drain to Binh Lau pumping station which will be constructed on an catchment area of 71.22ha. The pumping station will have a capacity Q= 1.28 m^3/s. Pumping construction area is 30m^2, using 4 submerged pumps (3 operate, 1 backup), Q=2,500m^3/h for each pump, H =10m, pumping water via the cross culvert of the existing NH5 and connecting to the existing drainage system to Binh Han pumping station.

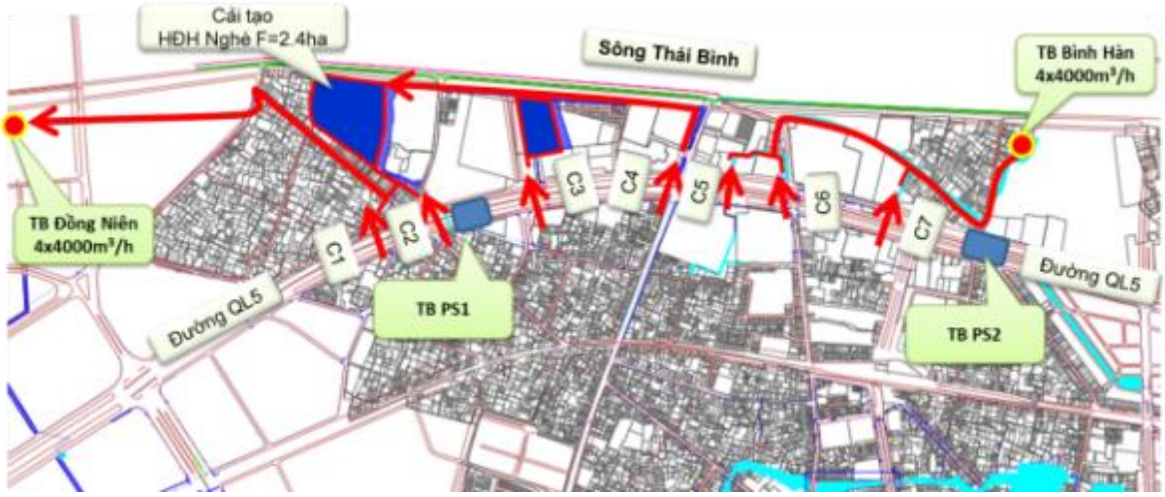


Figure 1.6: Rehabilitation Options for the Catchment Area in the North of the Railway

(3) Lining T1 canal embankment (from the intersection with NH5 to Sat river) and Lo Cuong pumping station

❖ *Lining T1 canal embankment*

Hai Duong city has a low-lying terrain surrouned by the dykes of Sat and Thai Binh rivers so the gravity drainage capacity is not effective in heavy rains when the river level rises highly. Therefore, the city's drainage system would use forced pumps. T1 canal is one of the main city's drainage systems. However, the Lo Cuong A drainage pumping station with an existing capacity of 1,000m^3/h is not able to drain for a large catchment area F = 473.56ha, affecting the drainage of the city. Thus, the project will dredge and line embankment for T1 canal with the following specification:

+ Dredging to the depth -1.

+ Lining the embankment for T1 canal on both banks, with a total length of 3.16 km. Slope 1:1, lining by precast concrete slabs grade 250, 500x500. The foundation will be cement mortar 75, 2 cm thick and the crushed stone 1x2, 10cm thick, the bottom layer will be non-woven geotextile layer and the embanked soil compacted with K=0.95. The embankment top will be arranged with handrail.

+ Construct the management road of 3m wide along 2 banks.

+ Construct the lighting system along the road.

Expand cross section of T1 canal for the water to flow into the suction chamber of the pumping station which will have a containing volume of 1,170 m^3. One secondary channel with B=3m will be arranged in front of the pumping station to drain water for T1 canal in case of no rain when the river level is now and T1 canal cannot drain it selft. On the channel, there should be 3 penstocks 3x3m for the management of the pumping station operation. The typical cross section design of Lining T1 cannal embankment is illustrated in Figure 1.4.

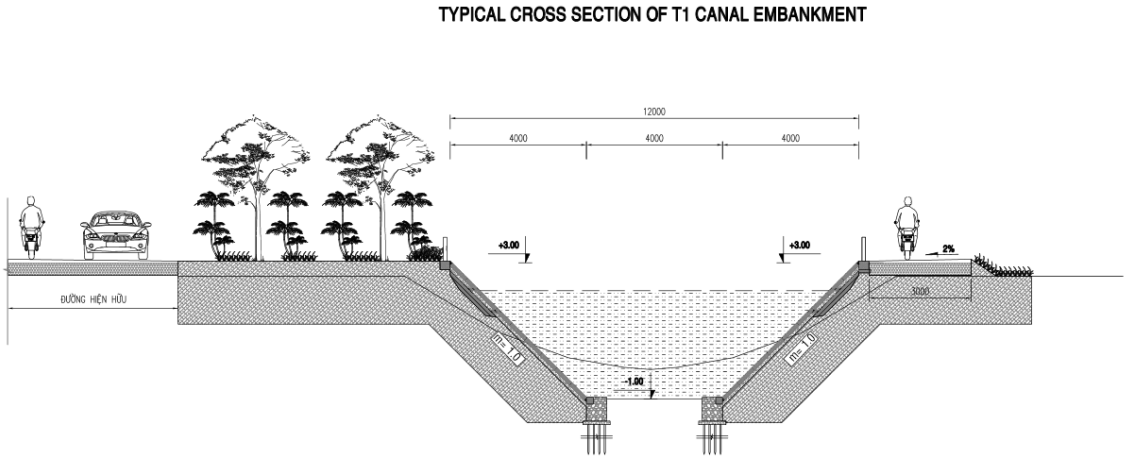


Figure 1.4: Typical Cross Section of T1 Canal Embankment

Lo Cuong pumping station (on the right bank of T1 canal at the section intersecting with Sat river):

Construction of a pumping station with capacity Q=11m^3/s on an area of 230 m^2, using 5 pumps (4 operating, 1 backup), with a pumping capacity of each pump of 9,900 m^3/h. The typical layout of Lo Cuong pumping station showed in Figure 1.4.

Figure 1.5: Typical Layout of Lo Cuong pumping station

(4) Lining the embankment on two banks of Bach Dang river:

Lining the embankment on two banks of Bach Dang river (from Tam Giang bridge to the dock):

+ To line the embankment on Bach Dang river banks, total length L = 2.8 km. Sloping embankment will be 1:1, lined with precast reinforced concrete slabs grade 250 with 500x500 size. The foundation will be cement mortar grade 75, thickness 2 cm and the compacted crushed stone layer 1x2 of 10cm thick, the bottom layer will be the no-woven geotextile fabric and the compacted soil layer K=0.95. The embankment top will be arranged with handrail.

+ To construct the management road of 3m wide along the two banks of embankment.

+ To invest in the lighting system along the road.

The typical cross section design of Bach Dang river embankment is presented in Figure 1.7.

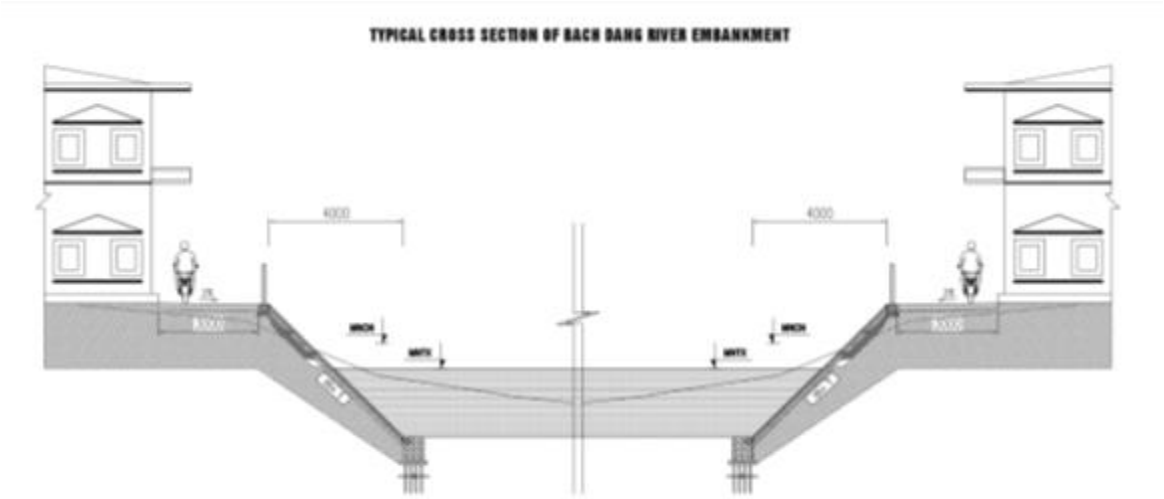


Figure 1.7: Typical cross section of Bach Dang river embankment

(5) To construct the wastewater collection system in the weset of the city:

To construct the separate drainage system for rainwater and wastewater: Collection pipeline has diameter from D300-D600 with total length L=127.1 km

The collection system will be the drainage system with septic tanks. The collection system will be connected to the septic tanks via the uPVC D110 service pipeline connected to the uPVC D160 service pipeline which will serve about 4-5 households and connected to the collection pipeline's manholes. Diagram of household wastewater collection and Diagram of wastewater collection and treatment are illustrated in figure 1.8 and 1.9, respectively.

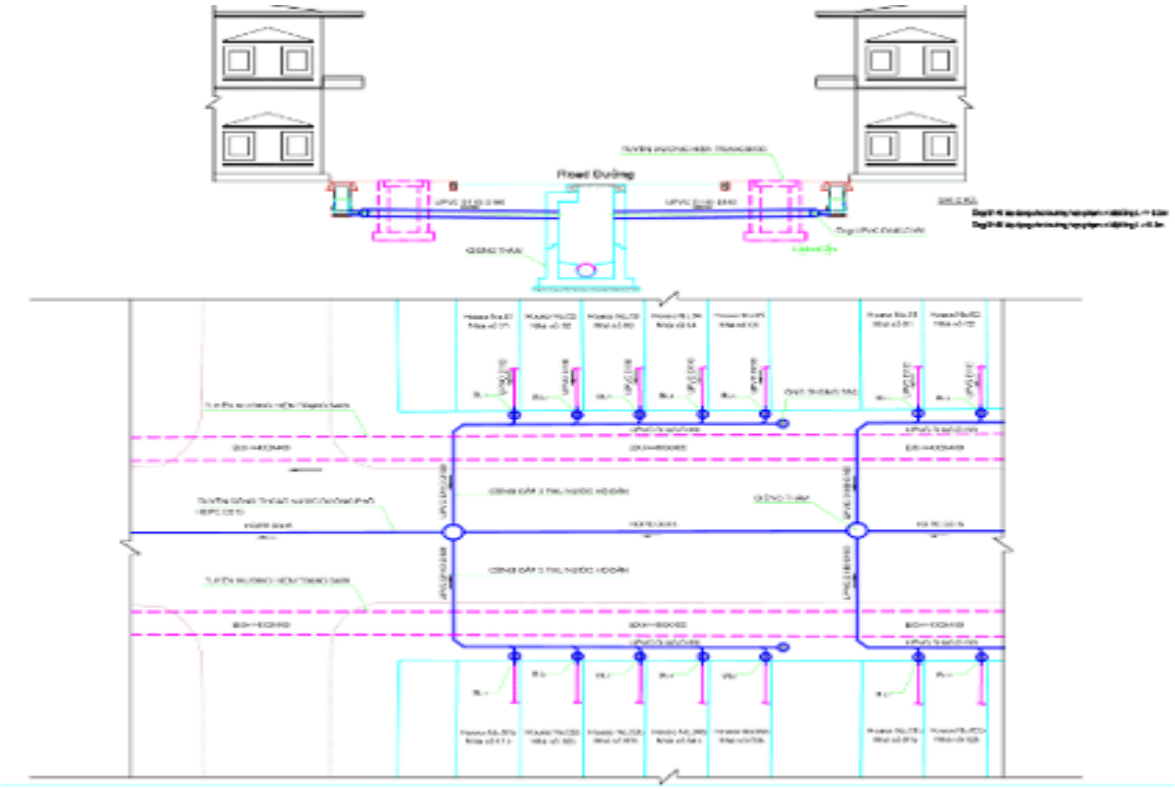


Figure 1.8: Diagram of household wastewater collection

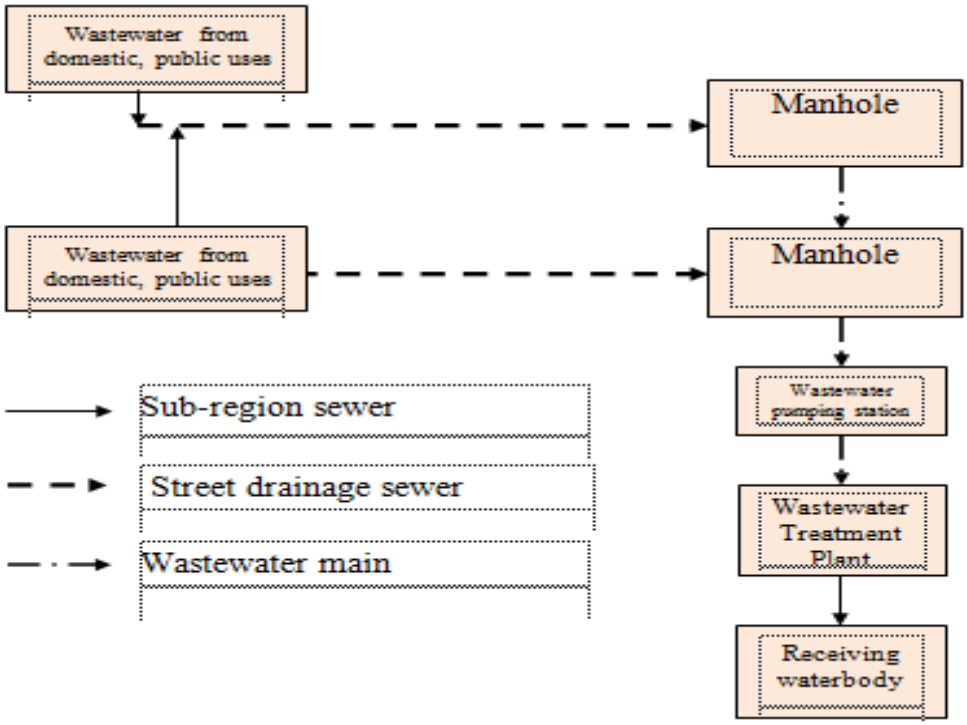


Figure 1.9: Diagram of wastewater collection and treatment

- *To construct 24 booster pumping stations:* The pumping station is arranged to suit with the controlled depth for culvert not over 4.0m, with capacity from Q=238 m^3/day to Q=12,000 m^3/day and the forced pipeline D300-D600, L=1.53 km. The booster pumps will be located at the center of the catchment area which is the most favorable location for collecting water from surrounding culverts to reduce culvert depth.

- *To construct the wastewater treatment plant:* The wastewater treatment plant will be located on the vacant land in Xuan Duong hamlet, Tu Minh ward. This is the favorable location which is 200m from Sat River's inlet. Moreover, to the downstream area of the tentative discharge from the wastewater treatment plant, there is no water plant to exloit water for domestic use. Thus, the expected effluent quality will meet type B in the standard QCVN 14: 2008/BTNMT.

Table 1.2: Wastewater standard as in QCVN 14/2008/BTNMT

No.	Parameter	Unit	Value C	
			A	B
1.	pH	–	5 - 9	5 - 9
2.	BOD_5 (20 ^0C)	mg/l	30	50
3.	Total Suspended Solids (TSS)	mg/l	50	100
4.	Total dissolved solids	mg/l	500	1000
5.	Sulfide (by H_2S)	mg/l	1.0	4.0
6.	Amonium (by N)	mg/l	5	10
7.	Nitrate (NO_3^-)(by N)	mg/l	30	50
8.	Oil, grease	mg/l	10	20
9.	Total surfactants	mg/l	5	10
10.	Phosphate (PO_4^{3-}) (by P)	mg/l	6	10
11.	Total Coliforms	MPN/100 ml	3,000	5,000

Quality of the influent wastewater is presented in following table:

Table 1.3: Quality of influent wastewater to the WWTP

No.	Parameter	Symbol	Unit	Value
1	Design capacity	Q	m^3/day	12,000
2	Estimated population	N	people	67,515
3	qcn: Water supply norm	Qcn	l/person/day	165
4	qtn: wastewater norm	qtn=80%qcn	l/person/day	132
5	Selected wastewater norm	Qtn	l/person/day	130
6	BOD5 content	La=a*1000/qtn	mg/l	269
7	a: BOD content of each person discharging per day (BOD_5 of wastewater deposited at household's septic tank)	A	g/person/day	35
8	Total suspended solids (TSS)	Tss=a*1000/qtn* 50%	mg/l	250
9	60% on the wastewater coefficient passing through the septic tank, then TSS reducing 50-70%			
10	a: Total suspended solids discharged by each person per day	A	g/person/day	65
11	Total input nitrogen	TN=a*1000/qtn*7 5%	mg/l	46
12	Nitrogen content can reduce 20-25% after passing through the septic tank		%	75%
13	a: Content of nitrogen in aminium ($N\text{-}NH_4$) generated by each person per day	A	l/person/day	8.0
14	Total input phosphate	TP=a*1000/qtn*6 0%	mg/l	15.2
15	Phosphate content can reduce 40% after passing through the septic tank		%	60%
16	a: Phosphate content (P_2O_5) generated by each person per day	A	l/person/day	3.3
17	Calculated temperature of wastewater	T	^oC	16.0
18	Input Coliforms	Total coliforms	MPN/100ml	10,000,000

Distance from the tentative location for the WWTP to the residential areas and residential clusters is short; the distance to the fence of Thanh Dong university is about 150m. Considering the local socio-economic condition, required quality of the treated wastewater (type B), location of the WWTP and the low management cost, Food Chain Reactor (FCR) technology is the most suitable option for treatment technology.

The main items in the FCR technology are: (1) Pretreatment, (2) Equilizer, (3) FCR reactor tank, (4) Coagulation tank, (5) Sedimentation tank, (6) Disinfection tank, (7) Sludge tank, (8) Sludge press, (9) Chemical house, (10) Control chamber.

Description of technology line

All collected wastewater goes through pre-treatment process where garbage, grit, sand, oil and greace are collected in the container tank and brought to treatment. Then the wastewater will run to the equalizer tank for flow rate regulating. In this step, the wastewater will be mixed to stabilize pollutant content before biological treatment. From the equalizer tank, wastewater will be pumped to the FCR chain.

The FCR technology uses aerobic treatment in different micro-biological environments in the chain steps. Reduction of organic matters and conversion of ammonia (mainly nitrate) at different process of the aeration. The agent for reducing organic matter, nitrifier and suspended high-level species takes more advantage than the biological membrance in the system. Fine bubble is supplied for the carrier and mixer to keep the free solid in the suspension.

Wastewater after the FCR treatment will run into the foculation tank where $Al_2(SO_4)_3$ solution will be added to precipitate phosphorous compounds.

From the foculation tank, the wastewater will directly run to the secondary tank. Under the gravity, solids will settle on the tank bottom. The remaining clear tank will run to the nitrification tank. Chemical agent to be used is NaOCl. After a period of retention in the tank, most of bacteria will be killed, the wastewater then meet the quality standard in Column B, QCVN 14:2008/BTNMT. The treated wastewater will then flow to the container tank for reusing in the plant.

Sludge deposited from the sedimentation tank will be pumped to the sludge tank where the air will be continuously fed to avoid anaerobic condition. Then the sludge will run directly to the press, polymer solution will be added for sludge dewatering. Pressed sludge will meet 20% of solid concentration and will be transferred to tanks. The water filtered from the sludge pressing will be reused in the plant.

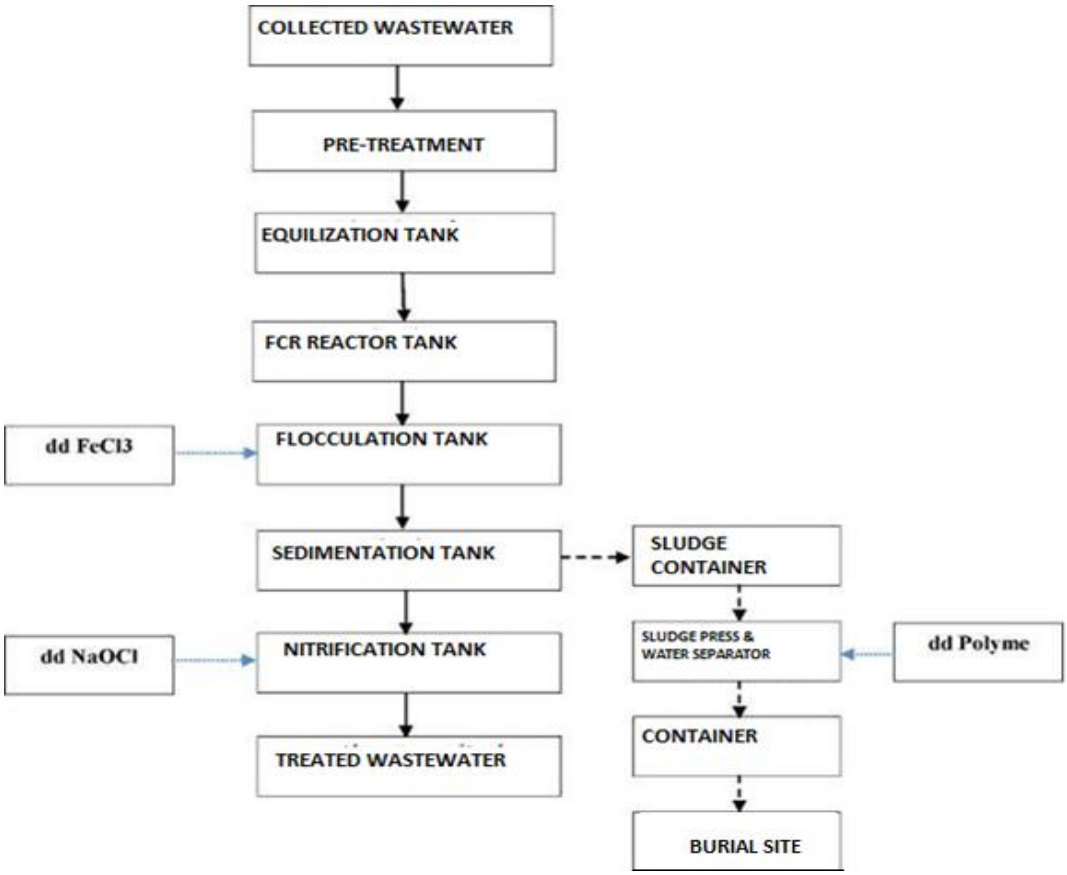


Figure 1.10: Wastewater treatment techonology using oxidation ditch method

❖ **Component 2: Technical Assistance and Investment Implementation**

Proposals in the project include

(1) Technical assistance proposal :

- Supporting the preparation and review of the province and city's plan and strategy with solutions for responding to climate change, green development and for sustainable development.
- Supporting the preparation of the plans for public transport and non-motorized development.

(2) Investment implementation:

- Consulting for the project preparation: Consulting for the formulation of project proposal, investment policy proposal, project document, topological and geological survey, safeguard instruments.
- Consulting for surveying and detailed design for both phases.
- Consulting for appraisal of design, preparation of bidding document and evaluation of bids.
- Consulting for construction monitoring, project evaluation.
- Consulting for independent environmental monitoring, resettlement.
- Independent auditing.
- Project implementation support.

(3) PMU cost and other expenses for appraisal fee, insurance, clerance of UXO.

1.2.3. Auxiliary facilities

Auxiliary facilities of the project include the access routes for transportation of the material to the project's construction sites, worker's camp, water and electricity supply sources. The existing roads and street will be used for access and transportation of construction materials to and from the construction sites. No new access roads will be constructed under the project.

1.2.3.1. Access road to the project's construction sites

❖ **Component 1: Improvement of Urban Infrastructure**

1) Complete technical infrastructure on Nguyen Luong Bang and Thanh Binh roads
- For Nguyen Luong Bang road: access roads to the construction site will include NH 5, Ngo Quyen street and the old Nguyen Luong Bang road section.
- For Thanh Binh road: access roads to the construction site will include NH5, road 3/10, Nguyen Van Linh, Truong Chinh, Ngo Quyen.

2) Improve rainwater drainage system in the north of the railway
- For the work item of Nghe lake: access roads to the construction site will include NH 5, Phan Dinh Phung, Trieu Quang Phuc, Ngo Thi Nham and the Dyke road.

3) Embankment of T1 canal and construction of new Lo Cuong pumping station: access roads to the construction site will include NH5 and Vu Manh Hung. (In addition, the construction site can be accessible by 2 other routes like NH5- Road 3/10- Truong Chinh or NH5 – Thuong Dat – Vu Cong Dan)

4) Embankment of Bach Dang river: access roads to the construction site will include NH5, Thanh Nien and two roads on the two banks of Tam Giam river, Cau Com and Chuong Duong.
5) Construction of wastewater collection and treatment system: access roads to the construction site will include NH5 and Thuong Dat road.

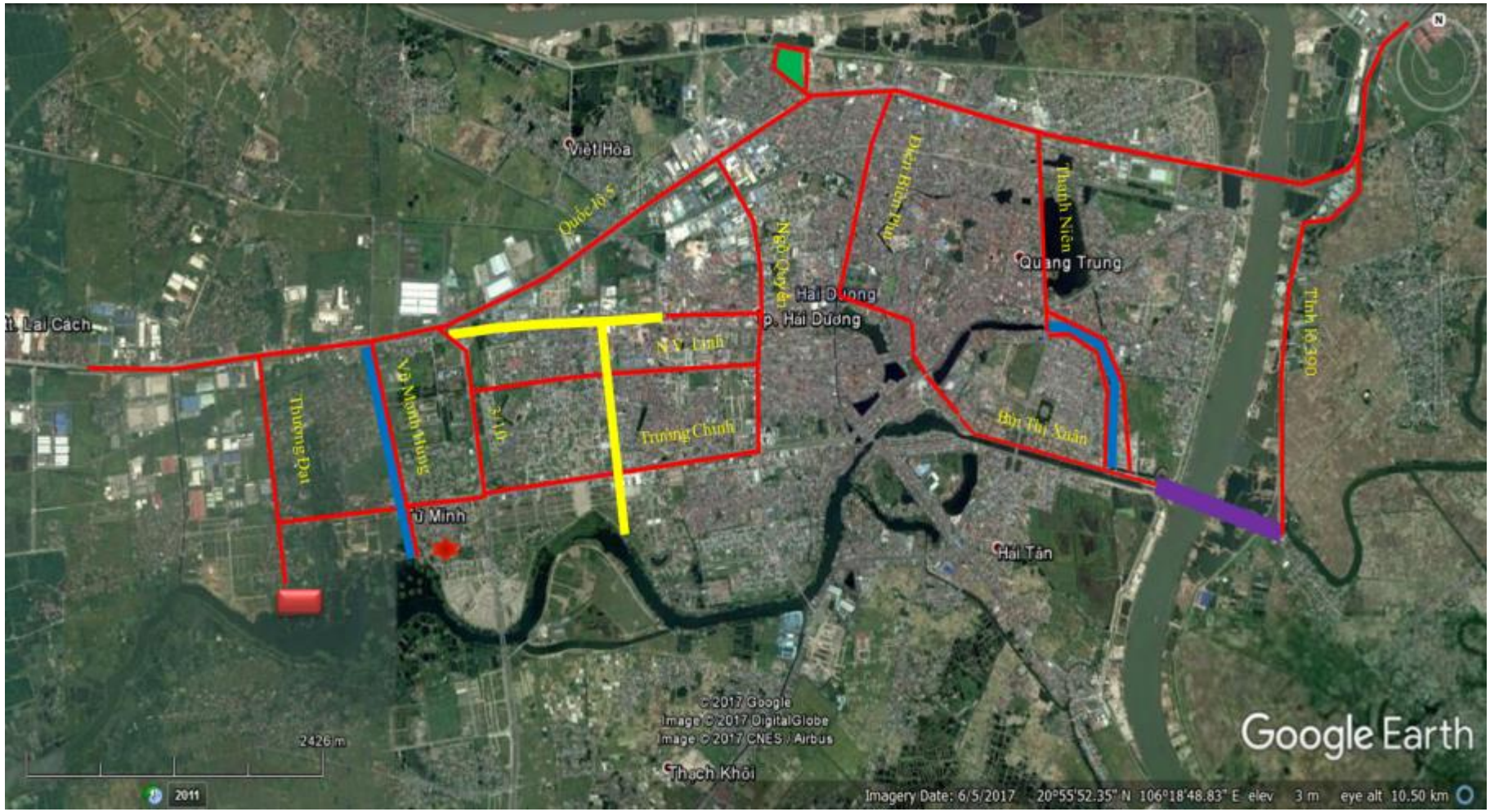


Figure 1.11: Main access routes to the project's construction sites

1.2.3.2. Tentative Locations of Worker's camp

About 230 workers will be mobilized for different construction activities at different construction sites of the project. Worker camps will be set up for construction workers, construction contractors, supervisory managers and engineers. Warehouses will be used to store materials and construction equipment. Table 1.4 presents some tentative locations for the worker's camps.

Table 1.4: Tentative locations of worker camps

Work items	Location	Number of workers	Scope of camp
Nguyen Luong Bang road and Thanh Binh road	The vacant land at the end point of Thanh Binh road	50	Two camps, $50m^2$/camp
Rehabilitation of drainage system in the north of the railway	The vacant land by the side of Nghe lake	40	One camp, $50m^2$
T1 canal embankment and new Lo Cuong pumping station	The vacant land at the end point of T1 canal or the area of Lo Cuong pumping station	50	One camp, $60m^2$
Embankments on two banks of Bach Dang river	The vacant land at the end of Bach Dang river, adjacent to the dock	40	One camp, $50m^2$
Construction of wastewater collection and treatment system in the west of the city	The vacant land in the area for construction of the treatment plant.	50	One camp, $70m^2$

1.2.3.3. Water and power sources for construction activities

Power source: The contractor will work with the town's electricity authority to arrange for connection to the town's electricity existing network to supply power for the construction activities and workers's use. Mobile generators will also be prepared to be used as needed.

Oil and gasoline to operate construction machinery at construction sites will be provided by local petroleum companies. With the available distribution network, the supply of fuel for the subproject is relatively convenient.

Water for construction and daily use will be taken from local clean water source. Water before use should be checked and tested in accordance with current standards. The constractor will work with relevant authority for water supply connection. In addition, drinking water can also be supplied in tanks to serve within the construction site.

For daily life of construction workers: The daily water demand is based on the water norm for on-site construction workers in accordance with TC 20TCN 4474-87 "water norm for meal preparation is 25 liters/person/day" and in accordance with TC 20TCN33 – 85 "water norm for bathing and washing is 45 liters/person/day".

1.3. Disposal Site

1.3.1. Waste Disposal Options

The construction works in Hai Duong project include drainage installation, canal embankment, thus the waste generated during the construction work will be typically solid waste, sludge and domestic waste and wastewater. There is no hazardous waste generated as according to the quality test of sludge, metals are under acceptable limits but organic content is higher. Thus sludge is classified as organic contaminated sludge. The amount of waste is estimated based on the scale of the proposed investments.

Table 1.5: Volume of construction solid waste during the construction

Work items	Volume of excavation and demotion	Volume of backfilling	Volume of dredged material	Domestic wastes
	m^3	m^3	m^3	kg
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	3,000	46,400	-	24,300
Rehabilitation of the rainwater drainage in the north of the railway	76,884	57,506	67,531	19,400
T1 canal embankment and construction of the new Lo Cuong pumping station	24,000	19,200	6,400	24,300
Embankment on two banks of Bach Dang river	10,700	46,400	4,640	19,400
Construction of the wastewater collection and treatment system in the West of the city	520,822	60,313	-	24,300
Total	**635,406**	**229,819**	**78,571**	**111,700**

- *Waste stones and soil* : According to the feasibility study, the total volume of waste stone and soil to be generated is about **635,406** m^3, the volume of backfilling soil is about **229,819** m^3. The excavated material will be partially reused for leveling roads in the project area while the remaining construction wastes will be disposed at the disposal site at Tu Minh ward (in Hai Duong city. This disposal site is under management of Hai Duong Transport Company. In addition, the project can dispose the wastes at the areas where the waste can be reused for backfilling and leveling work under the agreement between the parties and confirmation of the Project Management Unit.

- *Dredged materials*: it is expected that there will be about **78,571** m^3 of dredged sediment and excavated soils generated from dredging of Nghe lake and the ditch system in the north of NH5 and from Bach Dang river embankment lining, and excavation for construction of the WWTP. The analysis of the sediments in these sites indicates that they are not contaminated with hazardous substances. These dredged materials are not expected to be hazardous, and thus can be transported and treated to Tu Minh landfill or can be partially reused as soil supplement by the households near the project.

- When the project is brought into operation, it is expected that about 751 m^3 of dredged materials generated from the dredging of canal and from the WWTP will also be transported to Tu Minh landfill in Viet Hong commune.

- *Domestic waste*: Daily domestic solid waste generated from the worker camps will be collected. The contractor will contract with Hai Duong Urban Environment Joint Stock Company for domestic solid waste collection and transport to Seraphin Hai Duong Waste Treatment Plant in Viet Hong commune, Thanh Ha district in Hai Duong province. This plant uses treatment technology under Spainish technological line, with disposal site area about 153,665m^2.

- *Hazardous solid waste:* generated under the project includes waste oil, oily cloth, oil rags from the maintenance and repair of the transportation vehicles and machineries, will be collected and stored temporarily in the warehouse located at the site. Then, the contractor will sign a contract with a competent entity, Seraphin Hai Duong Environment Joint Stock Company, an eligible company (as defined in Circular 36/2015 dated 30 June 2015 by Ministry of Natural Resources and Environment on the management of hazardous waste) for treatment.

1.3.2. Transportation Routes

Roads for transportation of materials and wastes are NH5, Truong Chinh, Ngo Quyen, Thanh Nien, Bui Thi Xuan and Thuong Dat. Figure 1.12 presents the main routes for transportation of materials and wastes.

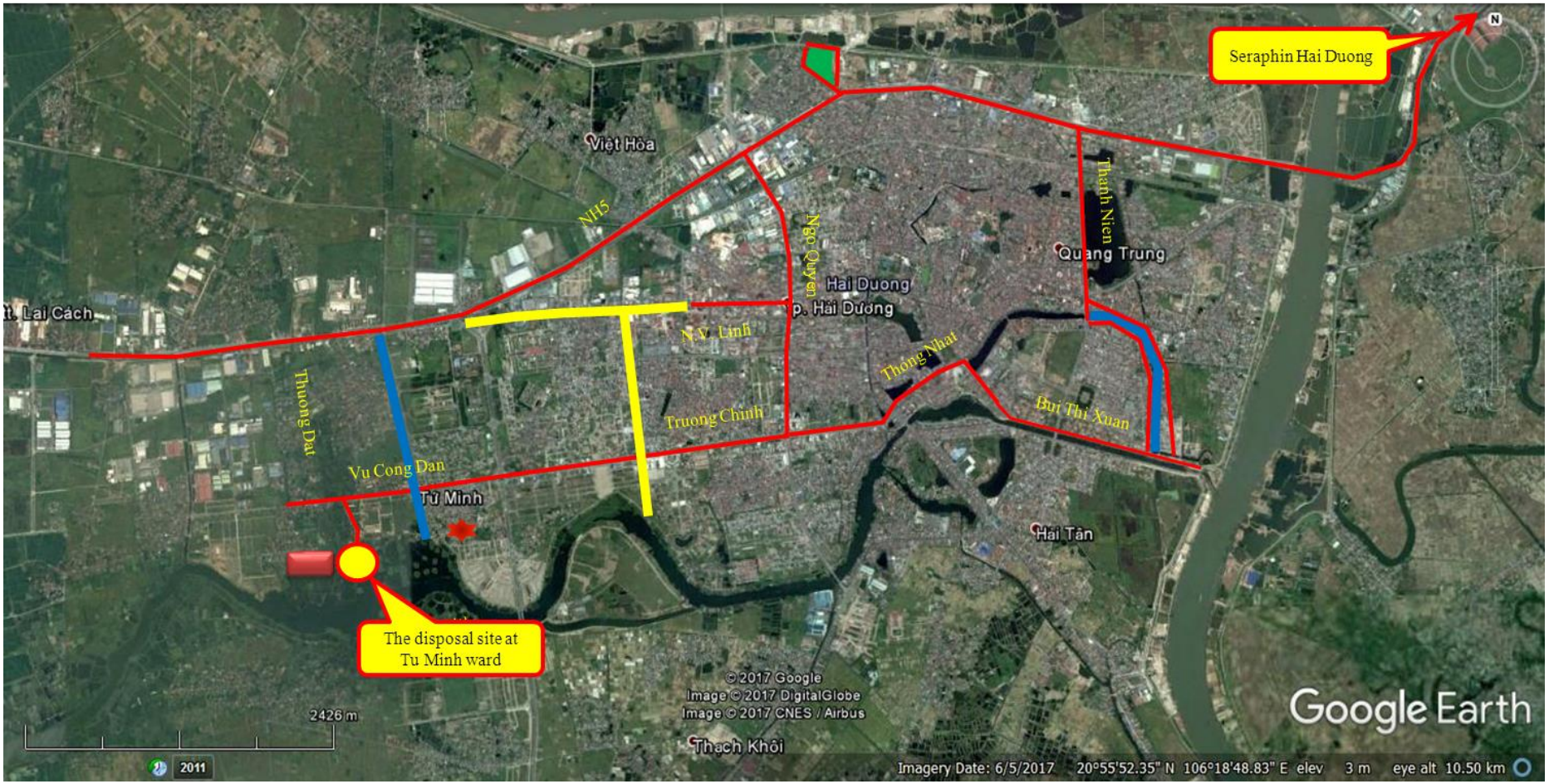


Figure 1.12: Main road for transprotation of material and waste

1.4. Project's Area of Influence

The project's area of influence (AOI) extends beyond its actual locations, mainly through the ongoing discharge of drainage and wastewater flows. Beside the footprints of component 1, AOI extends further a distance of 500 m beyond, considering sensitive receptors within that area, including residential areas, schools, hospital, religious buildings and traffic system. This distance is selected based on the most significant impact which is noise caused by pile driving (works to sensitive receptors. The area of influence is variable and dependent on either direct or indirect impacts and the affected resource. The ecology boundary extends 1 kilometer from the project area.

Dust, noise, vibrations and degraded environmental quality from odors and exhaust fumes will mainly be confined close to the construction sites, but nearby schools and temples may be affected. Local traffic and the larger connector roads will be affected beyond the actual sites as a result of materials transport to and from construction sites. Businesses, public and religious facilities, such as schools, pagodas and temple in the vicinity of actual construction sites, are particularly affected by traffic disruptions. As an important mitigation measure, the implementation of the project will be in two phases. This means that through good planning, coordination, scheduling and construction, the areas affected by the construction activities will be limited.

The need for the disposal of excavated unsuitable material and of dredged materials will extend the area of influence of the project to the transportation corridors, i.e. the disposal sites in Tu Minh ward and Seraphin Hai Duong Waste Treatment Plant in Viet Hong commune. Moreover, the need for good quality gravel and sand as construction materials extends the area of influence to quarries and borrow sites, at times well outside the city boundaries. The ESIA review showed that existing permits for legal excavation cover the project's needs but during project implementation, full compliance with local environmental regulations dealing with sand extraction, will have to be enforced and monitored. Generally, large quantities of construction materials, such as gravel and stones from the provinces will be transported by barge on rivers and canals, extending the area of influence but reducing impacts. Table 1.6 below tabulates the detailed footprints generated from the project and sensitive receptors bounded within the area of influence.

Table 1.6: The area of influence and the sensitive receptors subjected to project activities

No	Work items	Affected area	Impacts	
			Dust, noise and vibration, traffic safety	Aquatic environment
1	Nguyen Luong Bang road and Thanh Binh road	Thanh Binh and Viet Hoa wards	Residents (within distance of 10-150 m) in Thanh Binh and Viet Hoa wards in the project area Hai Duong Medical College (70 m from Nguyen Luong Bang road); Hai Duong Tuberculosis and Lung Disease Hospital (adjoining Thanh Binh road) and Hai Duong Medi-Tech Universtiy Hospital (Adjoining Nguyen Luong Bang road)	Sat river
2	Rehabilitation of drainage system in	Cam Thuong, Binh Han and Viet Hoa	Residents (10-150 m) in Cam Thuong, Binh Han and	Nghe lake

No	Work items	Affected area	Impacts	
			Dust, noise and vibration, traffic safety	Aquatic environment
	the north of the railway	wards	Viet Hoa wards in the project area Lo Cuong Temple (30 m from T1 cannal);	
3	T1 canal embankment and new Lo Cuong pumping station	Tu Minh ward	Residents (10-150 m) in Tu Minh ward in the project area	Sat river
4	Embankments on two banks of Bach Dang river	Ngoc Chau, Pham Ngu Lao and Tran Hung Dao wards	Residents (10-150 m) in Ngoc Chau, Pham Ngu Lao, Tran Hung Dao and Hai Tan wards in the project area	Bach Dang river
5	Construction of wastewater collection and treatment system in the west of the city	Tu Minh ward	Residents (10-150 m) in Tu Minh ward; Thanh Dong university (150 m from the WWTP); Nhi Chau kindergarten (50 m from Booster pumping station No. 1); Viet Hoa kindergarten (10 from Booster pumping station No. 5); Tan Binh kindergarten (1 m from Booster pumping station No. 16); Tu Minhkindergarten (20 m from Booster pumping station No. 21); Dong Nien temple (35m from Booster pumping station No. 5); Co Hoai temple (30 m from Booster pumping station No. 10); Cam Khuc Pagoda (22 m from Booster pumping station No. 22); Local market (15 m from Booster pumping station No. 24).	Sat river

1.5. Construction Method

1.5.1. Construction Method for Embankment

Preparing the site and pile casting area, pile storing area and material storage, electricity and water. Starting the construction from the river toward the bank. Steps of construction: Clearing the site → excavating the foundation pit → driving piles → pouring stones to prevent erosion → installing the sheets → setting the stones bedhin the sheet → constructing the pile base, pouring and flatting the concrete base → pouring the concrete → paving the ballast and geotextile → backfilling the sand and levling the site. The excavation work can be done by bucket excavator. Excavated materials can be reused for backfilling work and the balance will be transported and disposed at the site allowed by competent authority. The embankment will be lined in sections, using bamboo piles or sheet piles for covering the area to prevent erosion. The excavated soil will be reused for backfilling or transported to disposal site.

Dredging and lining embankment: following the instructions for construction and acceptance of dredging and embankment for river/sea works in the decision No. 924/QĐ-KT4 by the Ministry of Transport. It is required to check the benchmark, clear possible unexploded ordnance before construction. Dredged materials are gathered on the construction site not over 1.5m high and at least 20m from the river bank, covered to prevent from being spilt to surrounding area. The sludge will be transported by tank with lids to dispose to allowed area.

1.5.2. Construction Method for the Wastewater Collection Network and Treatment Plant

All round culverts are reinforced concrete pipes precast at the factory using the centrifugal or vibration technology. The box culverts are cast-in-situ or assembled depending on practical demand or contractor's capacity.

Facilities on the route like pits, manholes, overflows…are cast in situ.

The pit for installation of the round culvert is excavated manually or mechanically using sheet piles or steel sections.

For the planned road, the manholes will be constructed on the planned road surface and the depth for sewer installation is at the existing depth.

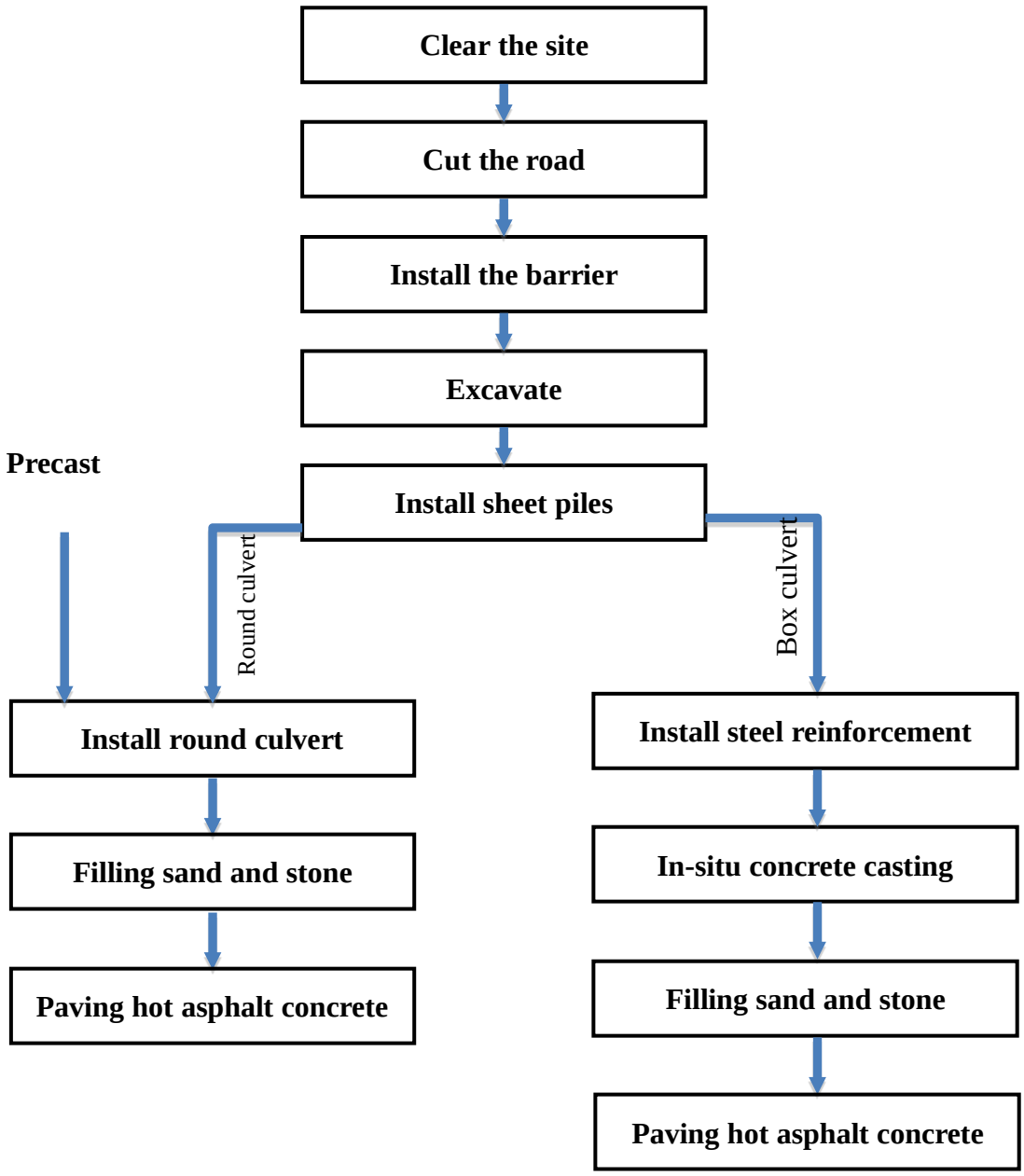


Figure 1.13: Construction of drainage culverts

1.5.3. Construction Method of Wastewater Treatment Plant

Remove the weathered soil layer, level the soil in layers of 200mm, and compact with K=0.95.

Reinforced concrete pile: pre-cast, construct by pre-casting method. Pouring the concrete at the site, foundation pit is > 3m deep, excavate mechanically and use sheet piles.

1.6. Expected Machinery, Equipment and Labor

Construction machinery and equipment are listed for each project's component as follows:

Table 1.7: List of machinery and equipment for the project

No	Machinery	Work items				
		Infrastructure on Nguyen Luong Bang and Thanh Binh roads	Rehabilitation of drainage system in the north of the railway	Embankment of T1 canal and construction of new Lo Cuong pumping station	Embankement on Bach Dang river	Construction of wastewater collection and treatment plant in the west of the city
1.	Single-bucket excavator, capacity 0.8m^3	4	2	2	2	2
2.	Bulldozer 108 CV	2	2	2	2	2
3.	Self-propeller grader 108CV	2	2	2	2	3
4.	Power shovel 2m^3	4	2	2	2	3
5.	Vibrating roller 10T	2	1	2	1	2
6.	Pneumatic roller 16T	2	1	2	1	2
7.	Watering car 5m^3	2	1	2	2	2
8.	Crane 130T	2	1	2	2	2
9.	Mortar mixer	2	1	2	2	2
10.	Water pump	2	2	2	2	2
11.	Asphalt paver	2	1	2	1	2
12.	Pile driver	0	0	2	2	2
13.	Generator	2	1	2	1	2
14.	Haul truck	2	2	2	2	2
15.	Steel bending machine	2	2	2	2	2
16.	Welding machine	2	2	2	2	2
17.	Welding transformer	2	2	2	2	2
18.	Rammer	2	2	2	2	2
19.	Concrete breaker	2	2	2	2	2
20.	Number of workers	50	40	50	40	50

1.7. Expected Labor Arrangement

The project is expected to mobilize about 230 workers for all work items. Contractors can hire local people as workers for manual work.

1.8. Demand of Materials and Backfill Soil source

According to the feasibility study report of the project "The Dynamic Cities Integarated Development Project- subproject Hai Duong city, Hai Duong province ", the demand for raw materials used for the construction project are presented in the following table 1.8:

Table 1.8: The list and quantity of raw materials used for projects

No.	Items	Weight			
		Cement (kg)	Sand (m^3)	Gravel (m^3)	Asphalt (kg)
1	Infrastructure on Nguyen Luong Bang and Thanh Binh roads	236,271	3,424	6,602	886,782
2	Rehabilitation of the rainwater drainage in the north of the railway	5,083,691	7,265	16,624	-

No.	Items	Weight			
		Cement (kg)	Sand (m^3)	Gravel (m^3)	Asphalt (kg)
3	T1 canal embankment and construction of the new Lo Cuong pumping station	1,886,180	2,670	5,805	-
4	Embankment on two banks of Bach Dang river	1,980,220	2,717	6,709	-
5	Construction of the wastewater collection and treatment system in the West of the city	1,980,220	2,717	6,709	-

Materials such as sand, earth materials and gravel will be purchased from Tu Ky, Chi Linh district, Hai Duong province or the nearby provinces.

- Steel will be purchased at factories in Hai Phong. Cement will be purchased from factories in Kinh Mon, Hai Duong.
- Hollow brick, solid brick, pavement tiles and glazed brick will be bought from Tien Kieu, Cong Cau port.

Locations of potential sources, capacities and operation permits are listed in Tables 1.9. All the materials shall be tested for the quality according to the current regulations. If the materials do not meet the technical standards, the contractor shall change to the other qualified sources. Demands for materials and technical supplies will be in accordance with the construction progress. The material supply will take into account the depreciation due to transport and unloading.

Table 1.9: Tentative material sources

No	Quarry name	Type of material sources	Location	Distance to project's site (Km)	Output (m^3/ year)	Reserve (m^3)	Exploitation permit	Environmental permit
Supplier/Companies (Will be identified at later stage)								
1	Quy Cao	Borrow pits	Quy Cao hamlet, Nguyen Giap commute, Tu Ky district	23	25,000	229,851	2543/GP-UBND on 27/09/2010	2543/GP-UBND on 27/09/2010
2	Dong Lac	Borrow pit and sand mine	Đồng Lạc commute, Chí Linh town	25	99,000	279,550	2244/GP-UBND on 04/08/2011	2244/GP-UBND on 04/08/2011

1.9. Investment Fund and Project's Implementation Schedule

The tentative schedule for the project's implementation as follows:

Table 1.10: Project's implementation schedule

No	Description	By when
1	Prepare Project proposal	03-2017
2	Prime Minister approves the project proposal	05-2017
3	Prepare investment policy proposal	06- 09/2017
4	Prime Minister approves the investment policy proposal	11/2017
5	Prepare for investment (consultancy for the formulation of FS and other instruments, detailed design for 30% investment)	09/2017 – 12/2017
6	World Bank's appraisal	12/2017
7	PPC approves FS and safeguard instruments	03/2018
8	Prime Minister approves RPF	04/2018
9	Negociate with WB	04/2018
10	Agreement takes effects	08/2018
11	Commence construction	2019-2023

Total investment of the project:

Table 1.11: Total investment of the project (1 USD =22,800)

No	Work item	Amount (USD)	
		IBRD	Counterpart
I	Component 1: Improvement of Urban Infrastructure	63,403,242	2,937,091
I.1	Construction cost (G1)	48,540,411	-
2	Construction of the wastewater collection and treatment system	31,304,855	
I.2	Cost for site clearance and resettlement		2,912,425
I.3	Cost for UXO clearance		
I.4	Consultancy cost	3,858,963	-
I.5	VAT tax:10% excluding site clearance cost	5,239,937	2,222.22
I.6	Contingency cost 10%	5,763,931	222.22
I.7	Sub-Total Component 1	63,403,242	2,937,091
II	Component 2: Technical Assitance and Investment Implementation	-	5,933,328
II.1	Consultancy cost for project preparation		1,213,510
II.2	Consultancy for project implementation		679,566
II.3	Technical assistance	-	1,377,778
II.4	Project Management Unit cost	-	728,106
II.5	Other cost	-	970,808
II.6	VAT:10% excluding PMU cost		424,166
II.7	Contingency cost		539,393
II.8	Sub-Total Component 2	-	5,933,328
IV	Total (component 1+ component 2)	63,403,242	8,870,419
V	Interest and fees in the construction phase	6,596,759	

No	Work item	Amount (USD)	
		IBRD	**Counterpart**
1	***Interest in the construction phase***	***6,004,797***	
2	***Commitment fee***	***416,962***	
3	***Font-end fee***	***175,000***	
V	**Tota investment (V+VI)**	**70,000,000**	**8,870,419**
		78,870,419	
	Percentage	**88.8%**	**11.2%**

CHAPTER 2. NATURAL, SOCIAL AND ECONOMIC CONDITIONS

2.1. Physical Condition

2.1.1. Geography

Hai Duong city is the provincial city of Hai Duong province with location as the urban center in the region. Hai Duong city has a strategic location in the key Northern Economic Zone with two important economic corridors of Con Minh – Lao Cai – Hai Noi – Hai Phong – Quang Ninh and Nam Ninh – Lang Son – Ha Noi – Hai Phong – Quang Ninh, near the North Central Coast economic corridor. Hai Duong is located 57km from Ha Noi capital, 47km from Hai Phong city, 80km from Ha Long city and 270km from Mong Cai, which is a great advantage for the province in general and Hai Duong city in particular in trading with Ha Noi, Hai Phong, Quang Ninh and other surrounding provinces like Bac Giang, Bac Ninh, Thai Binh and Hung Yen. Hai Duong city has 21 administrative units, including 15 wards and 6 communes, with a total area of 7,176 ha. The city borders with:

- Nam Sach district to the North.

- Nam Sach, Thanh Ha and Kim Thanh districts to the East.

- Tu Ky and Gia Loc districts to the South.

- Cam Giang district to the West.

2.1.2. Topolography and Geology

Topolography

Hai Duong city is located in a flat, low-lying terrain, inclining from Northwest to Southeast, from elevation +2.0m to +2.40m and toward +1.5m – 1.0m, or even +0.5m to +0.8m. The city has a diversified system of ponds and lakes connecting with rivers dividing the city into small basins. The area with elevation ≥ +2.0m is the constructed area such as Hai Duong city inner, village areas and cemetary area. The area with elevation ≥1.0m, < +2.0m is located scatteredly in wards and communes of Cam Thuong, Binh Han, Ngoc Chau, while the area with elevation < +1.0m is the low-lying area at the outskirt of the city.

Geo-engineering

Hai Duong city is located in the Red River delta with the alluvium derived and sedimented from the ancient Red river and Thai Binh River. The stratum at depths of 8m-10m are semi-clay, clay, silt clay with bearing strength R =1kg/cm^2. Buildings with over 3 floors all need foundation reinforcement.

2.1.2. Climate

Hai Duong is located in the tropical monsoon climate with 4 distinct seasons (spring, summer, autumn and winter).

Temperature: The average annual temperature ranges from 23^{o}C - 24.7^{o}C. The months with high temperature are May, June, July, August and September, while the months with low temperature are January, February and December. The total number of sunshine hours varies from 1,173 hours to 1,325 hours, and the months with high hours of sunshine are May, June, July, August, September and October; The average annual humidity ranges from 81% - 84%. Climate and weather are favorable for agricultural production, including crops, cereal, fruit trees, especially winter crops.

Rain: There are 120 to 130 rainy days per year in Hai Duong city on average, with the mean rainfall ranging from 1,400 to 1,500 mm/year. Rainy season starts in May and ends in

October. The rainiest month in the year is August while the driest month is December. The annual rainfall mainly focuses on the rainy season and accounts for 80-85% of the total annual rainfall. The average rainfall in rainy months is 150 - 290 mm. In recent years, the annual rainfall has tended to decrease compared to the previous decades. The distribution of rainfall has changed both in space and intensity.

Wind: The wind direction of the year changes in two seasons: summer and winter. The summer is the season of the Southwest and South-East winds where the prevailing wind direction is Southeast with the frequency of 35% -65%. In the early summer, there are 55% to 65% of Southeast winds, while the East winds also occur at a significant frequency from 10 to 20%. In the early summer (May and June), there are usually winds blowing from the West, the weather is dry with high temperature, over 35^{o}C, sometimes over 37^{o}C. The humidity drops below 55%, sometimes down to 45%. Normally, the dry and hot West winds appear in the beginning of June and end in early July but sometimes the West winds even appeared in early May and last until the end of August.

In winter: The cold Northeast wind dominates the weather all over the province. The wind is formed from the cold air blowing from the North. Annually, there are 20 to 25 monsoon winds on average affecting the weather in Hai Duong, or even more (from 25 to 35 winds) or less (15 to 20 winds). In the winter months (December, January and February), the Northeast wind is the severest, turning to the North with high speed where the highest speed is up to 15m/s and the popular speed is 5- 10m/s.

Typical meteorological characteristics:

- The highest wind speed is 40m/s (Storm level 13), this happened in the Storm No. 3 on 21/7/1977.
- The maximum highest temperature in Hai Duong by August 2013 was 39^{o}C (on 16 June 2013).
- The maximum rainfall in a day is 222.6mm (on 22/7/2004).
- The time with the maximum rainfall was from 20 July to 24 July 2004 with total rainfall of 444.7mm.
- Annual rainfall in 10 years (2003-2012) is 1,416mm.
- The hail on 21/11/2006 in Hai Duong had ice average size of 6-7cm or even bigger with diameter of 10-15cm causing damages to structural works and agricultural production.

2.1.3. Hydrology

Hai Duong city is surrounded by the two main rivers namely Thai Binh river and Sat river. Therefore, the hydrological characteristics of ponds, lakes and watersheds in the city are also affected by these two rivers.

a. Hyrological characteristics of Thai Binh river

- Hyrological characteristics of Thai Binh river in Hai Duong city

The Thai Binh river section flows via Hai Duong city is one curving section with wide and relatively deep riverbed. The two banks of the river sections are restrained by dikes. When the floods from Pha Lai flow in, the water usually drains slowly in this area. The current is frequently affected by tide even in flood season. In dry season, the river water rises (high tide) and withdraws (low tide) per day. In neap time, tide has two crests, one foot or two feet and one crest. In rising time, the tide is quite strong and has backflow.

In the rising tide in the middle of the dry season, there are usually 8 to 10 hours per day when

the water back-flows from the sea to the river. The maximum speed of the rising tide is from 0.5m/s to 0.6m/s. The highest water level difference in one day between the tidal peak and the low tide as measured at the Phu Luong hydrological station is from 1m50 to 1m60. The upstream flow is low and quite stable so the daily variation of water level in the river mainly depends on the Hon Dau tide. The average time for one tidal wave is 25 hours (from the first tide to the next tide) in the dry season. The tidal rising time is from 9 to 10 hours, the tidal neap time is from 11 to 14 hours.

Flood season: Usually starting from mid-May to the end of the October (In some years, the floods started earlier). During this season, the water rises depending on the amount of upstream floods and is still affected by the tide. The daily tide amplitude in this season is less than 0.80m – 1.20.

The water gradient in the year is quite high, the flood usually occurs as single-crest flood (floods occur individually). Each flood lasts from 5 to 7 days and neaps in 6 to 8 days. Sometimes, there are multiple-crest floods, often occurring in middle months of the flood season. In case of flood, the water level is regularly increased with the intensity of 1 - 2 cm/h and down with intensity from 0.5 - 1 cm/h. The early floods usually happen with greater intensity.

Height of the flood crest: In the flood season, in Hai Duong in general, there are 5 to 6 river floods on average. The highest flood in Thai Binh river as measured at Pha Lai Hydrological Station and Phu Luong hydrological station usually occurs from July to September, and sometimes even happens in June. The water level in these years are usually small or medium.

b. Hydrological Characteristics of the Sat river

Sat river: also known as Kim Son River, deriving from the estuary of the Red River through Xuan Quan culvert to the dock with total length of about 62km. Sat river belongs to the Bac-Hung-Hai irrigation system, which is used for irrigation purpose for Bac Ninh, Hung Yen and Hai Duong provinces. The last section of the Sat river flows through Hai Duong city (with a length of about 9.2km) and connects to Thai Binh river. Due to the city's urban development, the Sat river section flowing through the city plays the main function as a landscape river, regulating and draining water..., no longer serving the irrigation role for agricultural production.

- In rainy season, the water level of Sat River is usually> 2.0m: the maximum water level is 3.0m; Water level: from 2.40m to 2.80m.
- In dry season: Maximum water level is 2.0m; Regular water level in the Sat River is 1.6 m - 1.7 m.

The average and maximum water levels of Thai Binh river and Sat river flowing through Hai Duong city are higher than the average floor elevation of the city, so the two sides of the river have to be reinforced by dike system to protect against flooding.

2.1.4. Natural Resources

Land use

In 2016, the city had total land area of 7,266 ha accounting for 4.35% total the province's land area (doubled from 2006) due to the fact that in 2008, the city was expanded to include 6 communes (An Chau, Ai Quoc, Thuong Dat, Nam Dong, Thach Khoi, Tan Hung) of the two districts Nam Sach and Gia Loc and one part of Ngoc Son commune and Lai Cach township. The scope and use of land on Hai Duong city in 2017 is determined as follows:

Table 2.1: Land use in Hai Duong in 2017

No	Type of land	Area (ha)	Percentage (%)
1	Agricultural land	2,333.50	32.12
2	Non-agricultural land	4,919.32	67.71
3	Un-used land	12.85	0.18
	Total	**7,265.67**	**100%**

(Source: Hai Duong city Stastical Yearbook 2016)

The data shows that the percentage of agricultural land is much smaller than the percentages of urban land and industrial land. This has refelected the development orientation of Hai Duong city that is to focus on the industry-trade-service, gradually reducing the agricultural production. Besides, there is not much land budget for the non-agricultural sectors development and construction (only 12.85 hectares). In order to have more land for the development of new sectors, it is only possible to change the purpose of land use from agriculture to other sectors or areas, or to expand the administrative boundaries to expand the land budget.

Water resources

Surface water:

Hai Duong city has a quite diversified surface water source. There are two large rivers flowing through the city, namely Thai Binh and Sat River so the city is directly influenced by the hydrological regime of these two rivers. In addition, the city has a network of relatively dense ponds, which are connected to large rivers and small canals, facilitating the supply of water for production and living of the people.

Ground water:

The city's groundwater source has relatively high reserve compared to other areas in the Red river delta. The groundwater source in Hai Duong is mainly located in porous Pleistocene aquifer with the contents of chloride Cl <200mg/l. The water exploited at the stratum at an average depth of 40-120 m can be used for domestic use. The water in this stratum is of average quality, with a high total mineral content. The ion concentration of Na is 1.64, and Cl is 2.19. This is brackish water so it is necessary to have a strict treatment process before putting into production and living.

In addition, the groundwater found at some strata at the depths of 250-350m has good quality and large reserve, which can be extracted for production and people's domestic use. However, Hai Duong city has not exploited water resources of great depths.

Mineral resources:

Hai Duong currently has only two types of minerals to be exploited: river sand (black sand) and soil for producing red bricks.

River sand: There are two river sections flowing through Hai Duong city, namely Thai Binh river (with 13km length running through the city) and Sat river. Both these rivers have black sand resource that can be used as construction materials. However, at present, the sand in these areas has been too deep to be exploited, except for some dredging sites for urban drainage and flood control.

Land for brick production: In the city there are some areas where the soil can be used as raw materials for tunnel bricks, but the exploration, planning and management of these raw

materials are still inadequate and depend on the provincial policies as well as investment projects of enterprises.

2.1.4. Natural Hazards and Disasters

- *Storm and tropical depression:*

Hai Duong is located adjacent to the center of the Red river Delta, 20km from the nearest Hai Phong sea. As a result, the city is annually affected directly or indirectly by storms and tropical depressions from the East Sea or Pacific Ocean's Northwest on the northern coast, especially from Quang Ninh to Thanh Hoa. The rainy and storm season in Hai Duong lasts from June to October with high frequency in 3 months from June to September.

Over the past 53 years, there have been three storms at level 12 or over directly striking Hai Duong. These are the storm No. 5 on September 9, 1968 which directly hit Hai Phong province and turned to level-12 winds affecting Hai Duong with the rainfall of 22.6mm; the storm No.3 on July 21, 1977 which landed in Hai Phong, Thai Binh and Hai Duong at level-13 winds (40 m/s) and rainfall of 130.3mm; and particularly, the storm No. 4 in July 23, 1980 which also landed in Hai Phong and affected Hai Duong with level-12 strong winds and heavy rains on a large scale, causing rainfall of 586.7mm in Viet Hoa ward.

The number of storms varies within years. On average, Hai Duong is affected by one or two storms and tropical depressions. The years 1963, 1973, 1996 did have many storms, and the years 1965, 1989 had even four storms while there were the years with no storms affecting the city. Particularly from 1998 to 2002, there were no storms for 5 consecutive years.

Storms and tropical depressions often go with heavy rains, leading to large inundation. On August 28-30, 2014, under the influence of the tropical depression and the cyclonic disturbance in the South of the Red river delta, the whole province was affected by heavy rains. In Hai Duong City, many streets were flooded, causing traffic problems.

- *River floods' influence on Hai Duong*

The hydrological analysis of the Red River - Thai Binh river flood found that the flood from Duong and Luoc rivers tends to increase. Hai Duong province is threatened by Thai Binh river floods and affected by Red River floods across the Duong River and Luoc River.

Total river floods in Hai Duong caused by the Red River floods to Duong River account for 75% -80%. Flood season in Hai Duong usually lasts from the middle of May to the end of October (some years the floods started earlier). During this season, the water rises depending on the amount of upstream floods and is still affected by the tide. The daily tide amplitude in this season is less than 0m80 - 1m20.

The water level in the year is quite high, the flood usually occurs as single-crest flood (floods occur individually). Each flood lasts from 5 to 7 days and neaps in 6 to 8 days. Sometimes there are multiple-crest floods, often occurring in middle months of the flood season. In case of flood, the water level is regularly increased with the intensity of 1 - 2 cm/h and down with intensity from 0.5 - 1 cm/h. The early floods usually happen with greater intensity.

In the flood season, in Hai Duong in general, there are 5 to 6 river floods on average of which one will be the highest flood (with maximum crest in the year). Thai Binh river highest flood as measured at Pha Lai Hydrological Station and Phu Luong hydrological station usually occurs from July to September, and sometimes even happens in June. The water level in these years are usually small or medium. According to the measured data for many years, the frequency of occurrence of the highest flood falls in the following months:

Table 2.2: Frequency of flood occurrence in the year in Thai Binh river as measured by Phu Luong hydrological station, Hai Duong city

Month	6	7	8	9	10
Frequency (%)	7.5	30.0	45.0	17.5	0

(Source: Phu Luong Hydrological station- Hai Duong city, September 2013)

The years where the most serious floods happened in August were 1945, 1968, 1971, 1995, 1996. The floods in Hai Duong have affected the environment in rivers and flooded areas, such as:

- Increasing erosion and landslide of agricultural land in flooded areas.
- Increasing river bank erosion.
- Speeding up sedimentation in rivers.
- Changing water quality during floods.
- Changing the habitat and the livelihood and reproduction of fish during the flood period.

2.1.5. Baseline Environmental Condition in the Project Area

To asscess the baseline environmental condition in the project area, the Consultant has cooperated with the Center for Environment and Minerals to conduct the baseline environmental monitoring from October 3-13, 2017. The sampling locations and parameters are presented in Table 2.3.

Table 2.3: Environmental samples, sampling locations and parameters in the project area

No	Environmental sample	Location	Parameter
1	Ambient air quality	18	Micro-climate, CO, SO_2, NO_2, dust, noise and vibration
2	Surface water quality	10	pH, TSS, DO, COD, BOD_5, Amonium (by N), Nitrite (by N), Nitrate (by N), PO_4^{3-} (P), Cl^-, Fe, Surfactant, oil and grease, E.coli, Coliform
3	Sediment	8	As , Cu, Zn, Cd, Pb.
4	Wastewater quality	10	pH, BOD_5, TSS, H2S, COD, NH4+; NO_3^-; PO_4^{3-}; Coliform; Surfactant, oil and grease
4	Groundwater quality	2	pH, hardness (by CaCO3), chemical oxygen demand (COD), Chloride (Cl-), Nitrate (NO3-), lead (Pb), zinc (Zn), ferrite (Fe), Total Coliform
5	Soil quality	5	As , Cu, Zn, Cd, Pb.
6	Aquatic ecosystem	3	Plankton, benthos

2.1.5.1. Air quality and noise

16 air samples were taken within the project area in Hai Duong city on October 3, 2017. The specific sampling locations are presented in table 2.4. Sampling map is presented in Annex 3.

The analyzed results are presented in table 2.4 and are compared with the national standards in following national technical regulations:

- QCVN 05: 2013/BTNMT: National Technical Regulation on Ambient Air Quality (on an average of one hour);
- QCVN 06: 2009/BTNMT: National Technical Regulation on Permissible Maximum Concentration of Some Hazardous Substances in Ambient Air;
- QCVN 26: 2010/BTNMT: National Technical Regulation on Noise in Residential Areas.

The data in table 2.4 show that the air quality at the surveyed sites is quite clean and the parameters are within the limits of the national technical regulations on ambient air quality, noise, and vibration.

Table 2.4: Air quality in the project area

Symbol	Work item	Location	Parameter								
			Wind speed	Temperature	Moisture	Dust	NO_2	SO_2	CO	Noise	Vibration
			m/s	*°C*	*%*	µg/m^3	µg/m^3	µg/m^3	µg/m^3	dBA	dB
KK1	Nguyen Luong Bang and Thanh Binh roads	Nguyen Luong Bang – Vu Huu intersection	0.9	29.8	67.3	0.132	0.045	0.076	3.42	66.4	61.2
KK2		Nguyen Luog Bang – Thanh Binh intersection	0.9	28.7	62.3	0.243	0.052	0.077	3.65	62.3	60.4
KK3		End of Thanh Binh road (adjacent to Sat river)	1.2	30.3	66.4	0.116	0.047	0.082	4.01	64.5	59.8
KK4	Nghe lake + the ditch system in the north of the NH5	Nghe lake (near the residential area)	1.1	30.7	61.9	0.128	0.056	0.07	4.32	63.4	59.9
KK5		Dien Bien Phu – NH5 intersection	1.1	30.1	63.2	0.198	0.054	0.078	4.36	64.5	61.3
KK6		Truong Han Sieu –NH5 intersection	0.9	29.9	67.4	0.143	0.048	0.094	3.98	67.4	60.9
KK7		Dinh Van Ta road near Viet A furniture factory	0.9	29.8	62.3	0.154	0.55	0.089	3.89	64.5	61.2
KK8		Nguyen Khuyen – Phan Dinh Phung intersection	1	30.1	64.3	0.165	0.061	0.076	4.12	63.4	63.2
KK9	T1 canal + Lo Cuong pumping station	Start point of T1 canal – Tan Dan road	0.9	30.2	67.3	0.143	0.064	0.098	4.02	67.4	65.4
KK10		Vu Manh Hung – Vu Cong Dan intersection	1	29.9	66.9	0.154	0.061	0.088	3.89	68.4	54.4
KK11		New Lo Cuong pumping station – Lo Cuong village's temple	1	31	64.5	0.176	0.054	0.083	4.11	68.5	59.8
KK12	Bach Dang river embankment	Tam Giang bridge	1.1	30.4	69.3	0.156	0.063	0.089	4.21	67.4	58.7
KK13		Chuong Duong bridge	1.1	29.8	63.4	0.134	0.064	0.98	3.98	69.2	61.2
KK14	WWTP	Area for construction of the WWTP (behind Thanh Dong university)	1.2	30.1	65.4	0.143	0.065	0.076	4.09	68.7	62.1
KK15		Dien Bien Phu – Nguyen Thuong Man intersection	1.1	29.9	65.6	0.154	0.059	0.087	4.21	68.3	63.2
KK16		Nguyen Van Linh – Ngo Quyen intersection	0.9	29.8	64.8	0.144	0.061	0.078	4.12	69.1	62.3
QCVN			**-**	**-**	**-**	**0.3**	**0.2**	**0.35**	**30**	**70**	**75**

2.1.5.2. Surface water quality

The ESIA consultant also carried out sampling of the surface water at 09 locations in Hải Dương city from October 3, 2017. The sampling map is shown in Annex 3. Table 2.5 below shows the sampling location of surface water in the project areas.

Table 2.5: Surface water sampling locations

No.	Work item	Sampling location	VN 2000 coordinate system	
			X	Y
NM1	Nghe lake + the ditch system in the north of the NH5	Nghe lake	2314667	583621
NM2		The drainage ditch crossing with Dinh Van Ta road	2317422	587355
NM3	T1 canal + Lo Cuong pumping station	T1 canal - start point of Tan Dan road	2315822	581516
NM4		T1 canal - Vu Manh Hung – Vu Cong Dan intersection	2315849	581555
NM5		Sat river – location for construction of Lo Cuong pumping station	2314638	587331
NM6	Bach Dang river embankment	Bach Dang river – Tam Giang bridge	2316030	587050
NM7		Bach Dang river – Chuong Duong bridge	2315958	586423
NM8	Wastewater treatment plant	Area for construction of the WWTP	2314296	581344
NM9		Sat river – tentative discharge location	2314309	581349

The analysis results are shown in table 2.6 and compared with the standard QCVN 08-MT: 2015/BTNMT – National Technical Regualtion on Surface Water Quality. The results are compared with the standards for the purpose of domestic water supply with appropriate treatment (column A2) of QCVN 08-MT/2015 showed that COD, BOD_5 concentration are higher than the allowable limits at most of measurement points. COD concentration is 2.5 to 4.3 times higher than the permited limit. The BOD_5 concentration is higher than the permited level of column A2 from 2.8 to 5.6 times. The highest COD and BOD_5 concentrations are measured at the NM7 and NM8 sites in Sat river near the wastewater treatment station and Bach Dang river near Chuong Duong bridge. Since the Sat river and Bach Dang river are receiving waste water of the households around, the water quality is seriously polluted. Similarly, compared to water used for irrigation purposes and inland water purposes, the requirements for water quality are lower (columns B1, B2). The COD, BOD_5 concentrations, surfactants are higher than the permited limits. This indicates that the surface water in the project area is contaminated with organic matter as the rivers, lakes and canals in the project area receive wastes and domestic wastewater from surrounding households.

Table 2.6: Quality of surface water samples taken in the project area

No.	Parameter	Unit	Analysis results									Analysis method	QCVN 08-MT:2015/BTNMT		
			NM1	NM2	NM3	NM4	NM5	NM6	NM7	NM8	NM9		A2	B1	B2
1.	pH	-	6.12	6.56	6.34	6.19	5.98	6.04	6.32	5.89	6.18	*TCVN 6492:2011*	**6-8.5**	**6-8.5**	***5.5-9***
2.	DO	*mg/l*	3.42	3.11	3.09	2.98	3.42	3.76	3.13	3.46	2.99	*TCVN 7325:2004*	**≥ 5**	**≥ 4**	***≥2***
3.	BOD_5	*mg/l*	13.86	16.78	19.21	22.32	29.14	18.43	31.21	33.45	19.87	*TCVN 6001-1:2008*	**6**	***15***	***25***
4.	COD	*mg/l*	28.8	37.3	53.4	47.1	64.4	39.8	69.4	67.4	46.2	*SMEWW 5220C:2012*	**15**	***30***	***50***
5.	TSS	*mg/l*	36	43	27	54	46	30	43	29	39	*TCVN 6625:2000*	**30**	***50***	***100***
6.	NH_4^+_N	*mg/l*	4.43	0.51	1.98	0.65	1.08	3.44	1.02	0.18	1.32	*TCVN 6179-1:1996*	***0.3***	***0.3***	***0.9***
7.	NO_3^-_N	*mg/l*	3.20	4.32	1.98	1.32	0.98	3.23	3.54	4.53	6.73	*TCVN 6180:1996*	**5**	***10***	***15***
8.	NO_2^-_N	*mg/l*	1.54	0.031	0.43	0.16	2.31	1.78	0.22	1.09	0.32	*TCVN 6178:1996*	***0.05***	***0.05***	***0.05***
9.	PO_4^{3-}_P	*mg/l*	0.19	<0.008	0.22	0.65	0.07	0.091	0.48	0.98	0.67	*TCVN 6202:2008*	***0.2***	***0.3***	***0.5***
10.	Cl^-	*mg/l*	36.75	32.11	28.91	32.80	34.32	35.42	29.87	36.43	34.44	*TCVN 6194:1996*	***350***	***350***	**-**
11.	Fe	*mg/l*	0.1075	0.092	0.089	0.101	0.132	0.144	0.113	0.099	0.032	*TCVN 6177:1996*	***1***	***1.5***	***2***
12.	Total grease, oil	*mg/l*	0.8	0.8	0.6	0.8	0.6	0.6	0.4	0.6	0.6	*TCVN 5070:1995*	***0.5***	***1***	***1***
13.	Surfactant	*mg/l*	0.03	0.042	0.044	0.054	0.032	0.038	0.051	0.048	0.034	*TCVN 6622-1:2009*	***0,2***	***0,4***	***0,5***
14.	E.Coli	*MPN/ 100 ml*	90	60	160	120	120	14	35	36	15	*TCVN 6187-2:1996*	***50***	***100***	***200***
15.	Total Coliforms	*MPN/ 100 ml*	4,600	4,300	7,500	5,300	5,300	3,900	4,300	4,300	3,900	*TCVN 6187-2:1996*	***5000***	***7500***	***10000***

Applicable standard: QCVN 08-MT:2015/BTNMT: National technical regulation on surface water quality. For the purpose of domestic water supply but with suitable treatment technology or use purposes such as B1 and B2.

B1- For irrigation, irrigation or other uses with similar water quality requirements or for uses such as B2.

B2 - Waterways and other purposes with low quality water requirements.

2.1.5.3. Quality of domestic waste water

Domestic wastewater samples were taken at 9 locations in the project area. Table 2.7 shows the locations and coordinates of the sampling area.

Table 2.7: Sampling locations of domestic wastewater

No.	Description	VN 2000 coordinate system	
		X	Y
NT1	Cam Thuong ward residential area - NH 5	2317776	585865
NT2	Cam Thuong ward residential area - Dien Bien Phu street	2316767	585792
NT3	Binh Han ward residential area- Nguyen Thuong Man street	2317929	586697
NT4	Nhi Chau residential area - Phan Chu Trinh - Nhi Chau streets	2317819	587698
NT5	Ngoc Chau ward residential area- Tran Hung Dao - Tran Thai Tong streets	2316589	587800
NT6	Thanh Binh ward residential area - Nguyen Van Linh street	2315256	584314
NT7	Tan Binh ward residential area - Ngo Quyen street	2315616	584724
NT8	Hai Tan ward residential area- Thanh Nien - Nguyen Tuan Trinh streets	2316849	582555
NT9	Tu Minh ward residential area - Nguyen U Di street	2317237	583565

Analysis of the 9 samples of domestic wastewater taken in the project area shows that content of $NH4^+$ N is higher than the allowable limits at all the locations. The parameters of BOD_5 and Coliform are lower than the allowable limits at some sites such as NN5, NN6 and NN8. The remaining BOD_5 values are higher than the allowable limits set forth in the National Technical Regulation on Domestic wastewater (QCVN 14: 2008/BTNMT- collum B) from 1.1 times (NT4) to 1.5 times (NT7). The coliform value is higher than that of the permited limit from 1.06 times (NT4) to 1.28 times (NT7).

Table 2.8: Quality results of domestic wastewater

No	Parameter	Unit	Analysis result									Analysis method	QCVN 14:2008/ BTNMT (Column B)
			NT1	NT2	NT3	NT4	NT5	NT6	NT7	NT8	NT9		
1.	pH	-	6.35	6.12	6.44	6.83	6.12	6.06	6.45	6.71	6.53	*TCVN 6492:2011*	***5 – 9***
2.	BOD_5	*mg/l*	56.64	65.3	60.2	50.2	42.1	39.8	72.9	43.1	70.3	*TCVN 6001-1:2008*	***50***
3.	COD	*mg/l*	79.2	178.3	123.2	98.3	116.8	92.5	141.2	109.4	183.2	*SMEWW 5220C:2012*	***-***
4.	TSS	*mg/l*	48	87	64	55	54	67	76	66	73	*TCVN 6625:2000*	***100***
5.	NH_4^+_N	*mg/l*	24.82	19.8	20.3	18.7	19.3	20.1	17.8	16.3	19.6	*TCVN 6179-1:1996*	***10***
6.	NO_3^-_N	*mg/l*	<0.01	3.21	1.43	6.41	0.98	4.27	3.87	1.83	3.29	*TCVN 6180:1996*	***50***
7.	PO_4^{3-}_P	*mg/l*	1.84	4.32	5.23	5.42	2.19	1.87	3.24	6.54	4.98	*TCVN 6202:2008*	***10***
8.	Sunfua (H_2S)	*mg/l*	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	*TCVN 6637:2000*	***4***
9.	Surfactant	*mg/l*	0.031	0.025	0.027	0.033	0.031	0.028	0.029	0.030	0.031	*TCVN 6622-1:2009*	***10***
10.	Oil, grease	*mg/l*	1.1	2.3	4.1	1.9	4.3	2.3	2.9	3.2	1.7	*SMEWW 5520 B&F:2012*	***20***
11.	Total Coliforms	*MPN/ 100 ml*	4,200	6,400	5,300	5,300	4,200	4,300	4,600	5,300	3,900	*TCVN 6187-2:1996*	***5.000***

2.1.5.3. Soil quality

Analysis results of the 3 soil samples taken in the project area show that the content of Pb, Zn, As, Cd and Zn elements of all samples were within the allowable limits of QCVN03-MT: 2015/BTNMT – National Techincal Regulation on the Allowable Limits of Heavy Metals in the Soils, with reference for land used for living purposes.

Table 2.9: Results of soil quality analysis

Sample symbol	Work items	Sampling locations	Measurement and analysis parameters				
			Copper (Cu)	**Lead (Pb)**	**Zinc (Zn)**	**Cadmium (Cd)**	**Arsenic (As)**
			mg/kg dry soil	mg/kg dry soil	mg/kg dry soil	mg/kg dry soil	mg/kg dry soil
Đ1	Nghe Lake + Water ditches system in the North of NH5	Nghe lake	12.37	49.95	49.86	1.48	1.76
Đ2	Canal T1 + Lo Cuong pumping Station	Construction area of Lo Cuong pumping station	22.14	34.21	56.83	1.45	2.13
Đ3	Wastewater treatment plant	Construction area of wastewater treatment plant	19.87	43.28	61.02	1.35	2.98
QCVN 03-MT:2015/ BTNMT	**Land used for industrial purposes**		**300**	**300**	**300**	**10**	**25**
	Land used for agricultural purposes		**100**	**70**	**200**	**1.5**	**15**
	Land used for living purposes		**100**	**70**	**200**	**2**	**15**

Đ1: *Nghe lake* *: Coordinate X: 2314664; Y: 583625*
Đ2*: Construction area of Lo Cuong pumping station* *: Coordinate X: 2314636; Y: 587334*
Đ3*: Construction area of WWTP* *: Coordinate X: 2314312; Y: 581349*

-Reference standard: ***QCVN 03-MT: 2015/BTNMT***- National Techincal Regulation on the Allowable Limits of Heavy Metals in the Soils.

2.1.5.4. Sediment quality

Sediment samples are taken in the project areas in Nghe lake, T1 canal, Bach Dang and Sat river. Exact locations and sampling map are provided respectively in table 2.10 and Appendix 3.

The analysis results presented table 2.11 show that heavy metal contents in the sediment samples taken in the project area are much lower than the allowable limits in the QCVN 43: 2012/BTNMT: National Technical Regulation on Sediment Quality.

Compared with QCVN 07: 2009/BTNMT: National Technical Regulation on Hazardous Waste thresholds, the heavy metal contents in the sediment samples are lower than the

permitted thresholds, indicating no heavy metal pollution on rivers, lake, and canals in the project area (the parameters are much lower than the prescribed levels).

Therefore, the dredged materials will be transported to Tu Minh landfill or can be partially reused as fertilizer by the households near the project.

Table 2.10: Sampling location of sediment

No	Work item	Location description	VN 2000 coordinate system	
			X	Y
B1	Nghe Lake + Water ditches system in the North of NH5	Nghe Lake	2314603	583624
B2		Drainage ditch adjacent to Dinh Van Ta street	2317422	587355
B3	T1 canal+ Lo Cuong pumping Station	T1 canal, Tan Dan road	2318220	581516
B4		T1 canal, intersection with Vu Cong Dan road	2315849	581555
B5	Embankment of Bach Dang river	Bach Dang river –Tam Giang bridge	2314638	587331
B6		Bach Dang river–Chuong Duong bridge	2315958	584230
B7	Wastewater treatment plant	Sat river area - the tentative discharge area of the plant	2314309	581349

The analysis results are presented in Table 2.11

Table 2.11: Analysis results of sediment quality

Symbol	Parameter				
	Copper (Cu)	Lead (Pb)	Zinc (Zn)	Cadmium (Cd)	Arsenic (As)
	mg/kg dry soil				
TT1	32.44	54.12	56.44	0.125	4.32
TT2	54.34	49.56	67.39	0.105	3.09
TT3	45.34	55.67	76.34	0.085	5.12
TT4	20.98	62.1	70.21	0.095	2.38
TT5	32.33	56.32	54.89	0.135	1.98
TT6	27.87	62.33	48.98	0.115	3.45
TT7	35.46	64.35	38.98	0.125	2.87
QCVN 43:2012/ BTNMT (fresh water)	**197**	**91.3**	**315**	**1.5**	**17**
QCVN 07:2009/BTNMT Ctc (mg/l)	**-**	**15**	**250**	**5**	**2**
QCVN **03:2015/BTNMT (Agricultural land_**	**100**	**70**	**200**	**1.5**	**15**

2.1.6. Biological Resources

Biological resources in the project areas

The project is implemented mainly on residential land, urban land and agricultural land, gardens, vacant land and are under influence of people. The survey shows that there is urban and agricultural ecosystem in the area. Aquatic ecosystem includes river ecosystems (Sat, Bach Dang) and lake ecosystem (Nghe lake) and canals (T1 canal). Public consultation and site survey results show that, there is no rare or endangered species in the project areas.

Terrestrial ecosystem

The existing vegetation is mainly bushes. The popular animals are poultry and husbandry like ducks, chickens, dogs, cats…

Aquatic ecosystem

There are aquatic ecosystems in rivers (Sat, Bach Dang), lakes (Nghe, v.v…) and canals (T1 canal).

Ecosystems in Sat and Bach Dang rivers: Sat and Bach Dang are natural rivers. However, they are polluted with domestic solid and wastewater. There are onshore bushes and vegetation on the river's alluvial. There are households' cage fish farming along the rivers for Butterfish, Grass carp, Carpio, Tilapia.The Environmental Report in Hai Duong province also shows that, in 2015, there were about 22 species of fresh water available in the project area. However, no rare or endangered fish and aquatic species are found in Bach Dang and Sat river.

Fish cages along the Sat river (near Lo Cuong Pump station)

Situation on the bank of Bach Dang river

Ecosystem in Nghe lake and T1 canal: The lake, which is 0.5m deep, is heavily populated by local species. The vegetation is currently dominated by bushes. Aquatic plants include water hyacinth, duckweed and spinach. The vegetation of aquatic plants now thrives, covering the banks of the T1 cannal, or covering the Nghe lake. T1 canal is used by the city for combined dranage of domestic wastewater and rain water.

Current status of the construction area of the Lo Cuong pump station: Water hyacinth grows and the fish cage

Hyacinth and water potato grow strongly, covering both the Nghe lake

To asscess *Phytoplankton, Zooplankton and Benthos* stitutaion in Sat, Bach Dang river, Nghe lake and T1 canal, the consultant has to conduct the environmental monitoring baseline, October 3-13, 2017. Monitoring locations for aquatic environment quality sampling presented in the flowing table.

Table 2.12: Location for aquatic environment quality sampling

No	Location	Description
TS1	Water ditches system in the North of NH5	Nghe lake
TS2	T1 canal+ Lo Cuong pumping Station	Sat river – the location of Lo Cuong pumping station
TS3	Embankment of Bach Dang River	Bach Dang river –Tam Giang bridge
TS4		Bach Dang river–Chuong Duong bridge
TS5	Wastewater treatment plant	Sat river area to discharge disposal station
TS6	Bui Thi Xuan bridge	Thai Binh River at Bui Thi Xuan bridge construction area

Phytoplankton

Analysis results for samples taken at the project areas show that, there are 13 species in 8 families, 4 phylums of plankton, including *Euglenophyta, Chlorophyta, Bacillariophyta and Cyanophyta*. Details are presented in the table 2.13:

Table 2.13: Composition of algae species in the project area

No	Scientific name	Vietnamese name	Family		Genus		Species	
			Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
1	*Euglenophyta*	Ngành Tảo Mắt	1	12.50	1	9.09	1	7.69
2	*Chlorophyta*	Ngành Tảo Lục	3	37.50	5	45.45	5	38.46
3	*Bacillariophyta*	Ngành Tảo Silic	2	25.00	2	18.18	3	23.08
4	*Cyanophyta*	Ngành Tảo lam	2	25.00	3	27.27	4	30.77
Total			**8**	**100**	**11**	**100**	**13**	**100**

Among 4 phylums and 8 families, Chlorophyta accounts for 3 families, equivalent to 37.50%, then *Cyanophyta* and *Bacillariophyta* have 2 families, accounting for 25.00%. *Euglenophyta* accounts for the least amount, equivalent to 12.50%. Quantitative analysis shows that plankton concentration varies in the surveyed areas, from 3,200 – 10,200 cells/liters. Species of plankton found in the project area are popular species, no species in IUCN 2016, Viet Nam redbook 2007 are found.

Zooplankton

Analysis results show that, there are 18 species of 11 families, 4 orders, 2 classes of the 2 phylums of *Rotifera* and *Arthropoda*. Composition of the zooplankton is presented in following table:

Table 2.14 : Composition of plankton in the project area

No	Phylum	Class		Order		Family		Genus		Species	
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
1	*Rotifera*	1	50	2	50	6	54,55	6	42,86	10	55,56

No	Phylum	Class		Order		Family		Genus		Species	
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
2	*Arthropoda*	1	50	2	50	5	45,45	8	57,14	8	44,44
Total		**2**	**100**	**4**	**100**	**11**	**100**	**14**	**100**	**18**	**100**

Analysis results show that, 2 phylums of Rotifera and Arthropoda have the same numbers of class, order and family. Of which, *Brachionidae* family has the most species (3 species – accounting for 16.67% total species); *Chydoridae, Philodinidae, Trichocercidae, Daphniidae.*

There are also two species of Cyclopidae (accounting for 11.11% total species). Other families only account 5.56% total species. Most of the zooplankton found in the area are popular and normal species such as *Lecane bulla, Alona guttata guttata, Trichocerca longiseta, Brachionus caudatus*.

Quantitative analysis shows that, the average concentration of zooplankton in the sampling areas is 4,360 individual/m^3, of which the lowest concentration was found at T1 canal and Lo Cuong pumping station, with 2,800 individual/m^3, and the highest concentration was found at the sampling area on Sat river, near the discharge area of the WWTP: 6,500 individual/m^3.

Benthos

Benthos usually inhabit on the bed or on aquatic species with poor movement ability. Thus, when there is drastical change in environmental condition, or the condition exceeeds the benthos' resilience, then the benthos will die in mass and a new population will be generated to adjust with new habitat. Based on the variance and diversity in species and population size of benthos, it is able to evaluate the water quality in their habitat. This micro-organism is indicator for the pollution in the water. Surveyed results on 5 locations show that, there are 20 benthos scpieces belonging to 8 families, 6 orders, 3 classes of the two phylums namely *Mollusca* and *Arthropoda*. Composition of the benthos species is presented in table 2.15.

Table 2.15 : Composition of benthos species in the project area

No	Phylum	Class		Order		Family		Genus		Species	
		Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
1	*Mollusca*	2	66.67	5	83.33	6	75.00	11	78.57	14	70,00
2	*Arthropoda*	1	33.33	1	16.67	2	25.00	3	21.43	6	30,00
Total		**3**	**100,00**	**6**	**100.00**	**8**	**100.00**	**14**	**100.00**	**20**	**100.00**

Benthos species found at the surveyed area belong to Ampullaridae, Thiaridae, Viviparidae, Palaemonidae and Atyidae which account for the majority in the area, with 3 species (15.00% of total species) and ranking the second are Pachychilidae and Mytilidae with 2 species (accounting for 10.00% total species); and the last is Lymnaeidae family with only one species, accounting for 5% of total species.

Quantitative analysis shows that, the concentration of benthos varies from 4 – 28 individuals/m^2. At the sampling locations, avarage concentration of the benthos in the static water is much lower than the concentration in the moving water. Average concentration of benthos at the sampling locations is 16 individuals/m^2. The maximum concentration was found at the sampling location in Nghe lake and the ditch system in the north of the NH5, with coordinate of 00583624, 02314663 and the lowest concentration was found on Sat river,

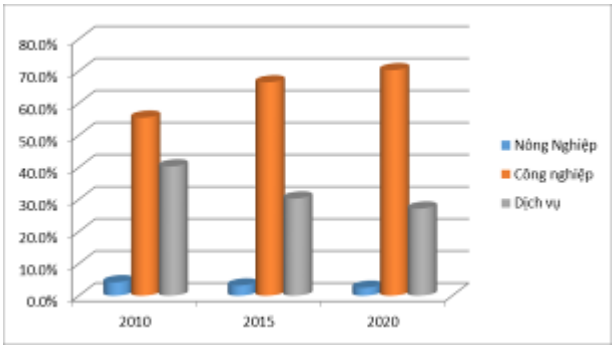
at the discharge area of the WWTP, with coordinate of 00581348 and 02314310. Average H indicator of the benthos found at the sampling locations varies from 1.74 to 3.02, corresponding with poor and medium bio-diversity to good biodiversity. Avearge H indicator for the whole surveyed area is 2.1, this means that the biodiversity of benthos in the surveyed area is fairly good.

Natural reserves: There is no natural reserve in Hai Duong city in particular and Hai Duong province in general.

2.2. Social and Economic Conditions

2.2.1 Economic conditions

The GDP per capita of Hai Duong is higher than the national average level. The life of people in the city has been improved. The industrial parks have completed their infrastructure and attracted more than 300 investment projects.



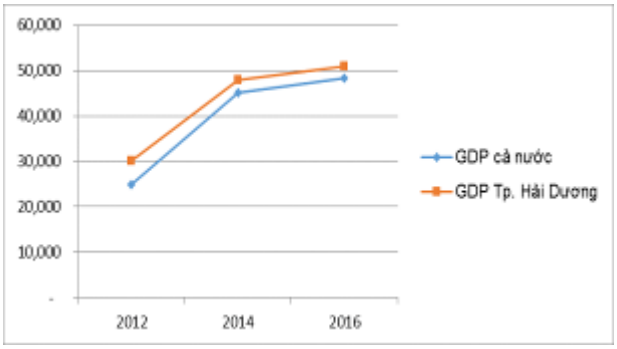


Figure 2.1: Economic structure transition and GDP of Hai Duong city in 2012-2016

2.2.2. Social condition

The population of Hai Duong city in 2016 was 231,662 people with a population density of 3,188 people/km^2, of which the rural population was 9.76% and the urban population was 90.24%.

Table 2.16: Population in Hai Duong city

No	Administrative units	Population
1	Cam Thuong ward	9,125
2	Binh Han ward	21,619
3	Ngoc Chau ward	16,734
4	Nhi Chau ward	7,215
5	Quang Trung ward	13,163
6	Nguyen Trai ward	11,782
7	Pham Ngu Lao ward	12,198
8	Tran Hung Dao ward	5,661
9	Tran Phu ward	6,920
10	Thanh Binh ward	19,364
11	Tan Binh ward	13,974
12	Le Thanh Nghi ward	8,395
13	Hai Tan ward	15,284
14	Tu Minh ward	14,176
15	Viet Hoa ward	8,964
16	Ai Quoc ward	14,049
17	An Chau commune	3,929
18	Thuong Dat commune	2,789
19	Nam Dong commune	8,406
20	Thach Khoi ward	10,425
21	Tan Hung commune	7,495
	Total	**231,662**

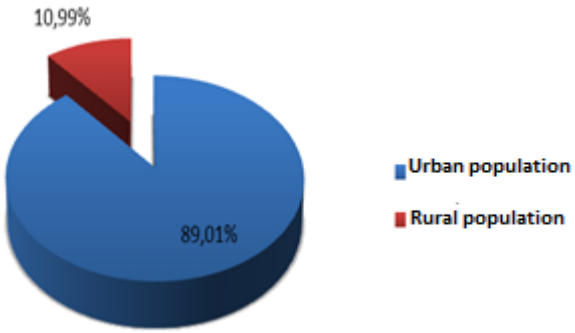


Figure 2.2: Population structure in Hai Duong city in 2016 (%)

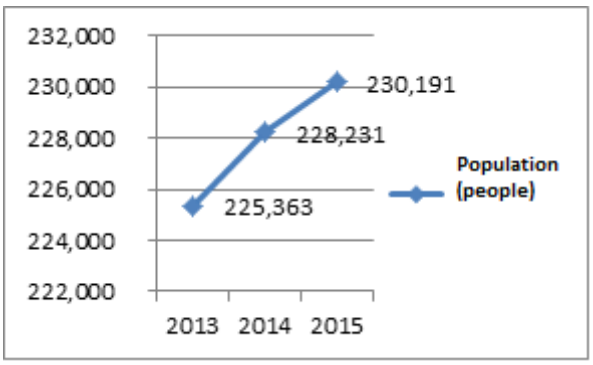


Figure 2.3: Hai Duong population over the years (people)

b.2. Labor and Employment

Vocational training, job creation and labor export have achieved many results. There is coordination between levels, sectors, units of vocational training and job placement. In the 2011-2015 period, annually, about 7,054 people have been participated in vocational training courses and got the jobs from job placement programs. The percentage of trained workers was 71.0%.

By strengthening and promoting labor export, in collaboration with companies with labor export functions to organize consultancy services on employment and labor export for those who have needs to go to work overseas, in the four years from 2011-2015, 1,200 people have been recruited and sent to work abroad, thus reducing the unemployment rate of working-age workers to 4.3% by 2015.

The educational level of the city's workforce is quite high. In 2014, the number of people with secondary school decree level or higher level was 93.1% (of which the number of high school graduates was 76%) - higher than the average of Hai Duong province (81% and 74.3 %).

The quality of the city's workforce by professional qualification has made positive changes. In the 2001-2005 period, the average number of trained workers (from primary and higher education) increased by 13%/year (in which technical workers with a diploma or higher level degree gained 11.9%/year). Along with vocational training programs, the rate of trained labor (college or higher) of the city also increases.

❖ **Occupational structure of local people in the project area**

The main occupations for household's heads in the project area include : hired job/free job (35.2%), retirement (34.7%), government employee (9.1%), worker (6%), farmer (5.7%), vendor (5.7%) and unemployment (2.8%).

Most of household members earn living by doing hired jobs (this group accounts for 27.8% of total surveyed member). 12% are government employees, 12.6% are retired people and 8.3% are workers with stable monthly income. Number of affected households running businesses/opening shops (mainly at the market or at home) accounts for 4.4%. There is one small number of people working in agricultural production, accounting for 2.7%. Students and pupils account for a relatively high percentage of 20.6%. This result shows that, on average, number of dependent people in households including people with no income (including housewives), the elderly (no pension) accounts for a rather high percentage of 11.7%.

❖ **Income**

The main income source of people in Hai Duong city is from salary (19.1%), hired job (15.6%), agricultural production (14.5%). In addition, there are other income sources like social allowance, land rent. According to the survey, the average income of the affected

households is around 12.5 million VND/HH/month but the most popular income is about 6 million VND/household/month. The highest income is 38 million VND/HH/month and the lowest income is 4 million VND/HH/month.

b.3. Poor and near - poor

The poverty rate is determined by the average income per capita of the household. According to the latest statistics of the People's Committee of Hai Duong city in 2016, there were 1,914 poor households accounting for 3.26% of the city's total households, 1,221 near-poor households, accounting for 2.08% of the total households.

Table 2.17: Statistics of poor and near- poor households in Hai Duong city in 2016

No	Name of ward, commune	Total number of residential households	Number of poor households		Near-poor households at the end of the year	
			Number of households	Proportion	Number of households	Proportion
1	Nguyen Trai ward	2,238	44	1.97	5	0.22
2	Hai Tan ward	4,119	90	2.18	43	1.04
3	Tran Phu ward	1,721	41	2.38	9	0.52
4	Thanh Bình ward	3,967	114	2.87	70	1.76
5	Binh Han ward	5,062	97	1.92	7	0.14
6	Tan Binh ward	3,535	80	2.26	42	1.19
7	Le Thanh Nghi ward	2,067	54	2.61	29	1.40
8	Ngoc Chau ward	4,513	184	4.08	216	4.79
9	Nhi Chau ward	1,739	83	4.77	27	1.55
10	Tu Minh ward	3,086	150	4.86	132	4.28
11	Viet Hoa ward	2,586	110	4.25	67	2.59
12	Pham Ngu Lao ward	2,930	86	2.94	37	1.26
13	Quang Trung ward	3,442	68	1.98	36	1.05
14	Cam Thuong ward	2,300	45	1.96	15	0.65
15	Tran Hung Dao ward	1,285	43	3.35	15	1.17
16	Thach Khoi ward	2,665	124	4.65	21	0.79
17	Ai Quoc ward	4,276	194	4.54	116	2.71
	Urban area	**51,531**	**1,607**	**3.12**	**887**	**1.72**
18	Tan Hung commune	2,321	73	3.15	112	4.83
19	Thuong Dat commune	768	54	7.03	50	6.51
20	Nam Dong commune	2,653	125	4.71	141	5.31
21	An Chau commune	1,373	55	4.01	31	2.26
	Rural area	**7,115**	**307**	4.31	**334**	**4.69**
	Total	**58,646**	**1,914**	**3.26**	**1,221**	**2.08**

(Source: People's Committee of Hai Duong city)

By end of 2016, there were 947 poor households (3.2% of total population) and 600 near poor

households (2% of total population) in the project area. The percentage of poor and near poor households in the project area is equivalent to the City's percentage. Tu Minh ward has the highest percentage of poor households with 4.86% of poor households and 4.28% of near poor households. Nhi Chau ward ranked the second with 4.77% of poor households and, 1.55% near poor households and then Ngoc Chau ward with 4.08% of poor households and 4.79% near poor households. Binh Han ward is the ward having the lowest percentage of poor households (1.92% poor households and 0.14% near poor households).

2.2.3. Physical Cultural Resources

In Hai Duong city, there are 11 National-ranked relics and 19 Provincial-ranked relics as follows:

Table 2.18: Overview of relic clusters and relics in Hai Duong city

No	Relic name	Decision number, date of Decision	Current communes, districts	Land, area (m^2)
I	**National level relics, clusters of relics**			
1	Dinh Van Ta street relic	68, January 29th, 1993	Quang Trung ward– Hai Duong city	2.158
2	Bao Sai Temple - pagoda	68, January 29th, 1993	Pham Ngu Lao ward –Hai Duong city	4.191
3	Suot Temple	68, January 29th, 1993	Thanh Bình ward– Hai Duong city	3.663
4	Dong Nien Temple	226, February 5th, 1994	Viet Hoa commune– Hai Duong town	4.894
5	Ngoc Uyen Temple	226, February 5th, 1994	Ngoc Chau ward -Hai Duong city	797,4
6	Tu Dong Temple	141, January 23rd, 1997	Cam Thuong ward - Hai Duong city	1.705
7	Lieu Trang Temple	97, January 21st, 1992	Tan Hung – Gia Loc communes	3.609
8	Vu Thuong Temple - pagoda	1460, June 28th, 1996	Ai Quoc – Nam Sachs commune	6.43
9	Van Xa Temple - pagoda	04, January 19th, 2001	Ai Quoc – Nam Sach communes	1.666
10	Vu Xa Temple	04, January 19th, 2001	Ai Quoc – Nam Sach communes	953
11	Khanh Hoi Temple	04, January 19th, 2001	Nam Dong – Nam Sach communes	1.376
II	**Provincial level relics, clusters of relic**s			
1	Phuong Do Temple	No.629/QĐ-UBND dated 07/02/2005	Cam Thuong ward - Hai Duong city	TS = 2.205, K1 = 810, K2= 1405
2	Phuc Duyen Temple - pagoda	No. 629/QĐ-UBND dated 07/02/2005	Hai Tan ward –Hai Duong city	TS = 4.485, K1 = 1505, K2= 2.980
3	Nhi Chau Temple - pagoda	No. 4981/QĐ-UBND dated 01/11/2005	Nhi Chau village – Ngoc Chau ward – Hai Duong city	TS = 12.885, K1 = 914, K2= 11.971
4	Cam Khe Temple - pagoda	No. 4764/QĐ-UBND dated 28/12/2006	Cẩm Khê village –. Tu Minh commune– Hai Duong city	TS = 3.044, K1 = 620, K2= 2.424
5	Nghe Nhoi	No. 4533/QĐ-UBND	Area 5 –Thanh Bình	TS = 1.301, K1 =

No	Relic name	Decision number, date of Decision	Current communes, districts	Land, area (m^2)
		dated 19/12/2009	ward –Hai Duong city	180, K2= 1.121
6	Vu La Temple - pagoda	No. 3717/QĐ-UBND dated 21/10/2009	Nam Dong commune– Hai Duong city	
7	Phu Tho Temple	No. 629/QĐ-UBND dated 07/02/2005	Phu Tho village - Thach Khoi commune	TS = 1.254, K1 = 1.018, K2= 236
8	Khue Chien Temple	No. 4537/QĐ-UBND dated 19/12/2007	Khue Chien village – Tan Hung commune– Gia Lộc	TS = 3.721, K1 = 500, K2= 3.221
9	Tran Xuan Yen Temple and Tomb	No. 629/QĐ-UBND dated 07/02/2005	Tien village - An Chau commune	TS = 579, K1 = 579
10	Ba Lieu Temple	No. 3716/QĐ-UBND dated 2/11/2010	Hai Tan –Hai Duong city	TS = 3.088, K1 = 1.384, K2= 1.704
11	Le Quan Temple	No. 3716/QĐ-UBND dated 2/11/2010	Thach Khoi –Hai Duong city	TS = 2.480, K1 = 1.200, K2= 1.280
12	Thanh Lieu Temple	No. 3409/QĐ-UBND dated 14/12/2011	Tan Hung –Hai Duong city	TS = 6.904, K1 = 2.017, K2= 4.887
13	Lo Cuong Temple	No. 3410/QĐ-UBND dated 14/12/2011	Tu Minh ward –Hai Duong city	TS = 3.331, K1 = 1.272, K2= 2.059
14	Dam Loc Temple	No. 420/QĐ-UBND dated 07/02/2013	Tan Binh ward–Hai Duong city	TS = 932, K1 = 715, K2= 217
15	Huong Hai Pagoda	No. 429/QĐ-UBND dated 07/02/2013	Ai Quoc –Hai Duong city	TS = 21.197, K1 = 16.097, K2= 5.100
16	Ca Pagoda	No. 440/QĐ-UBND dated 07/02/2013	Viet Hoa ward–Hai Duong city	TS = 3.264, K1 = 1.690, K2= 1.574
17	Ba Xa Temple - pagoda	No. 426/QĐ-UBND dated 07/02/2013	Thuong Dat commune–Hai Duong city	TS = 4.932, K1 = 4.932
18	Dong Quan Temple	No. 433/QĐ-UBND dated 07/02/2013	Tan Hung commune–Hai Duong city	TS = 4.907, K1 = 2.527, K2= 2.380
19	Do Xa Temple	No. 196/QĐ-UBND dated 20/01/2015	Tu Minh ward–Hai Duong city	TS = 1.863, K1 = 1.863

(Source: Report on the Modification of Hai Duong city Master plan by 2030 with a vision to 2050).

Within the project area there are (i) Lo Cuong temple, Cam Khuc pagoda in Tu Minh Ward; (ii) Han pagoda, Co Hoai temple in Cam Thuong ward, (iii) Kim Chi pagoda in Thanh Binh ward; (iv) Dong Nien temple in Viet Hoa ward. Han pagoda (Cuc Lac pagoda) was constructed in the Later Le dynasty, around the year 1477 with location in Han Thuong commune, Han Giang district, Thuong Hong province, now as Cam Thuong ward, Hai Duong city. Kim Chi pagoda was constructed in the Ly dynasty, around the 13th century in Thanh Binh ward, Hai Duong city. Dong Nien temple has ranked as national-level relics. Han pagoda and Kim Chi pagoda have not ranked as national and provincial-level relics but are the centers where there are religious activities of the Buddhism and local people. In addition to religious and spiritual values, the pagodas also have certain historical values as the base and hiden place for soldiers in the war.

2.3. Infrastructure and Services

2.3.1. Education

The school system from pre-school to high school is expanding, spacious and diversified towards socialization. The network of educational institutions has developed strongly bringing learning opportunities for everyone, initially forming a learning society. In order to improve the quality of comprehensive education, the development of a standard school system has been of special interest by the city. In the 2016-2017 school year, there are 107 schools (public and private schools), 115 private nurseries with 1,658 classrooms and total 48,390 schoolers.

In 2016, 95.8% of children at school age went to school, of which, children at primary school age reached 100% (100% female children at primary school age went to school). The percentage of schooler at secondary school reached 99.5% (99.9% of female children attended the school). In the mean time, the percentage of schooler at high school age decreased considerably to 88% (female schooler of 89.7%).

The training and education sector of Hai Duong city has paid attention to fostering skills. The curriculum and teaching methods are renovated, testing and evaluating methods are also changed toward focusing on “input and output" quality, enhancing life skills education for students, organizing workshops, training and fostering for management staff and teachers. The quality of teachers is always improved in terms of quality, 100% of the teachers meet standard and the overall percentage of all three levels is 80% (the highest in the province).

The number of educators and education administrators has increased rapidly in terms of quantity and has basically overcome the structural inadequacies, meeting the requirements of universalization of education and the development of educational levels; there are 2,679 teachers and staffs all over the city with the rate of over-standard teachers of 67.1%, 93% and 75% for pre-school, primary school and secondary school levels, respectively.

- **Education background of the people in the project area**

Generally, education level of the project’s directly affected people is rather high. Percentage of affected household member being illiterate/not going to school is 5.5%, most of them are the elderly and pre-school children. 14.6% household members have primary schoold degree level, most of family members have secondary school degree (25.6%) and high school degree (42.2%); college/university 8.7%) and post graduate degree (0.7%).

2.3.2. Healthcare

The healthcare network in Hai Duong city is at both provincial-level and district-level. The provincial level consists of 9 general and specialized hospitals and 5 preventive medicine centers. In 2014, two additional centers (a 70-bed cardiovascular center and a 70-bed tumor center) were established under provincial general hospital. In addition, there are Medical High School and Pharmaceutical - Medical Supplies Company; College of Medical; Central Drug Intermediate School; Military Medical Institute 7. The medical examination and treatment establishments in Hai Duong city, especially the provincial hospitals have attracted a great number of people and patients from the districts in the province and from the districts in the nearby provinces to medical examination and treatment.The city level consists of four divisions: the Health Department, the General Hospital of the City, the City Health Center, the Center for Population Counseling and Family Planning.

Surveyed result in the project area shows that, 39% households have members getting respiratory diseases; 19.4% households have members getting water-borne diseases (dysentery, cholera…); 16.9% households have members getting other environment-borne dieases.

2.3.3. Gender issue

Surveyed result on gender issue in Hai Duong city shows that:

Education: The surveyed results show that, there is no educational restrict for female in the project area. At present, all children at school age can go to school regardless their gender, household's economic condition and religion.

Labor division: Over 60% surveyed people said that women take main responsibility for housework and purchasing necessities in the family. There is gender equality in taking care of children and the elderly in the family. Only 45.7% of surveyed people said this is women's responsibility. For repairing of houses, 60.7% of the surveyed people anwered that the men take that responsibility.

Participation in public meeting: Survey on participation in community activities and participation in local organizations shows that there is not much difference in gender. 56.1% of respondents said that both women and men participate in community and local meetings.

Making decision for family issues: For family decisions, the results show that in most of surveyed households, both men and women participate in discussing and making decisions. For decisions in family expensing, investment, changing careers and other big decisions, the percentage is 58.4%, 65.8% and 61% respectively.

2.3.2. Transport

Hai Duong is a province with favorable geographic location with many important traffic routes such as National Highway 5, Highway 18, Highway 10, Highway 37, Hanoi Highway, Ha Noi - Ha Long - Mong Cai (planning), Ha Noi - Hai Phong railway, Kep - Ha Long railway. There are many central rivers running through the city, facilitating Hai Duong's trading activities with Ha Noi, Hai Phong and Quang Ninh which are the economic developed provinces in the North and the whole country.

2.3.2.1. Road system

Hai Duong city has a relatively convenient road system with a total road length of nearly 314 km, distributed evenly across wards and communes and connected to other localities via national highways, provincial highway that runs through the territory of the Hai Duong City.

❖ *Roads for external exchange*

-National highway: the 2 national highways running through Hai Duong city are national highway 5 and national highway 37:

National highway 5: Connecting Hai Duong city with Hung Yen, Hanoi, Hai Phong and other localities in the northern key economic region. The section passing through Hai Duong city is 10 km, reaching the standard of grade I delta road. Some sections through Hai Duong are city standards. The structure of the road surface is asphalt concrete, the segregation road meets the grade-V road standard, asphalt concrete surface. Bridge system on the route is designed permanently, large load (H30-XB80) in accordance with the technical grade standards.

National Highway 37: connects Hai Duong city with districts in the province, the passage part through Hai Duong city has length of 5.37 km. The whole road is up to grade-III road standard - plain, asphalt concret and plastic rock.

-Provincial highway: Hai Duong city also has two provincial roads running through: Provincial route 390: The route has a total length of 38.9 km, starting from Nau Khe, Nam Sach, Hai Duong wharf, passing south through Nam Sach town, then cutting through National

Road 5, the route continues to round down to the East - South, through Thanh Ha town and ending in Quang Thanh, Thanh Hà, Hai Duong city.
Provincial route 391: The route has a total length of about 40 km, running from north to south, starting at the intersection of Highway 5 at Han wharf, Hai Duong city, going south, passing Tu Ky town to close the boundary between Hai Duong and Hai Phong provinces. The route runs to the west and ends at the intersection of Highway 37 at Chanh station - Ninh Giang town, Hai Duong province.

❖ *Urban transport*

Urban transport network of Hai Duong city was formed quite early. The road density is quite thick in the central area. Up to now, Hai Duong city has 284 named roads, streets, squares, streets (including 3 squares, 5 boulevards, 30 roads and 246 streets) and hundreds of un-named communal roads and concrete roads in villages and hamlets. Total length of urban roads is 207 km, with density of 5.87 km/km^2.

2.3.2.2. Railway

The Hanoi - Hai Phong railway with full length of 102 km passes through Hai Duong city with a section of about 10 km. The railway system has not changed much since it was built 100 years ago. The railway's width is 1m, relatively backward in comparison to the world.

2.3.2.3. Inland waterway

Hai Duong is one of the provinces in the Red river Delta - an area with advantages in inland waterway transport in our country. With rather diversified system of rivers (ranked second in comparison with other provinces in the country), the city's waterway conditions are relatively favorable. At present, most of the rivers meet the tertiary, quarternary standards and some evens meet secondary standard, affordable for navigation of ships/barges from 200-1000 tons. In Hai Duong city, there are two river systems, the Red River and the Thai Binh River, where there are inland waterway operation. Hai Duong is currently managing the shipping business on the Sat River. Traffic volume is relatively large: 5000 - 7000 trips/year. At present, there is no landmark for waterway traffic so the encroachment of the river bed to build the farm and aquaculture projects has affected the view of the means' driver and the signaling corridor is obscured, affecting the performance and traffic safety of waterway.

2.3.3. Water and Power supply

❖ *Water supply*

Hai Duong city is using water supplied by Cam Thuong, Oret, Viet Hoa water plants with total capacity of 65,200 m^3/day. These plants are located in the north of the city and exploit water from the Thai Binh river.

Currently, the water supply network covers most wards and communes of Hai Duong city with a water supply of 95%. At present, 3 water supply plants in Hai Duong city supply water to 6,427 households and 991 agencies. The rate of water loss across the city's water supply network is 13%, the average water demand for each person is 165 l/person/day.

The main pipeline network was built in 1978 and was refurbished in 1999/2000. Currently, the system of pipelines is operating relatively well, the capacity of water plants meet the demand for domestic water for the city's population. In the future, the city's water supply system will expand to Gia Loc, Binh Giang and Nam Sach districts.

❖ *Power supply*

Hai Duong city is supplied with 110kV national grid via 2 stations: 110kV Dong Nien (3x40 + 25) MVA and Dai An 110kV station with capacity of 1x63 MVA. Power supply from the 110kV Pha Lai - Dong Nien - Pho Cao, Pha Lai - Dong Nai dual wires, AC185 wires 28.8 km

long (load 175, 176 Pha Lai).

2.3.4. Status of drainage and wastewater treatment

Rainwater drainage status

Currently the city is using the combined drainage system with 5 main drainage catchments and is divided into levels including:

Catchment I - South bank of the Sat River:

- Inadequate drainage system
- There are existing sewers along provincial road 19 and some main roads
- The remaining area discharging to irrigation canals and then to the Sat River
- In Thanh Binh ward, drainage is quite good, Hai Tan ward has no sewerage system in the city.

Catchment II - In the inner city:

- The general drainage system is currently in use and divided into levels:
- Primary drainage system includes Hao Thanh, Binh Minh Lake, Bach Dang Lake and Bach Dang River. It is the place to receive wastewater from the inner city and other surrounding areas from secondary and tertiary systems, then drain to Thai Binh River, Sat River.
- Secondary drainage system includes underground culverts, box culverts, canals with slabs along the roads and small ponds among population clusters. The main system to receive rain water, waste water from the road, from the households, offices, factories and then into the primary system. Although the drainage work has been paid attention in recent years, but the secondary sewers system have not yet met the drainage requirements of the inner city.
- Tertiary drainage system: includes manholes of households, small drainage pipes that drain water from manholes or from households discharging into primary and secondary systems. This system is mostly built by households themselves.

Catchment III - the Southern bank of Thai Binh River

- The area between highway 5 and Thai Binh river dyke: Rainwater and wastewater are concentrated in an open ditch that runs parallel to the Han wharf into the city's drainage system.
- The northern section of the railway enters Binh Han pump station, the southern part of the railway is collected by the tertiary sewer system and then poured into the Hao Thanh system.

Catchment IV - Northern suburbs of Thai Binh river

- There is no complete drainage system. Rain water drains into natural terrain. Waste water drains directly into irrigation canals, lakes, and then into the field.

Catchment V - East coast of Thai Binh river

- There is no drainage system. All rain water, sewage all poured into irrigation ditches, then Bach Dang river.

In the inner city, there are main drainage routes to Thai Binh and Sat rivers. Because the city has a lower elevation than the highest water level and the average water level of the two rivers, there are dike systems surrounding area to prevent water from flooding.

The inner city is using pumping water drainage system, pumping water into Thai Binh and Sat rivers. Pumping system drainage for the city has a total of nine pumping stations involved in the drainage, including: 4 pumping stations with combined irrigation; 4 pumping stations for both urban and irrigation; only Ngoc Chau pumping station Q = 40,000m^3/h is for urban

irrigation. Some pumping stations such as Lo Cuong, Binh Lau pump stations have been degraded, affecting the basin drainage.

In the inner city and new industrial zones, there is a sewer drainage system with total length of 300 km of drainage culverts, 40 km of open drainage ditches with mixed structure (round culvert, box culvert, slabbed drains) and sizes from D400 to D2500; from BxH = 1.0m x 1.0m to 4.2m x 2.0m. Collected sewers discharge into the main sewers and canals such as the T1 canal leading water to the Lo Cuong pumping station; the T2 canal leads water to the Binh Lau pump station, the culvert on Nguyen Thanh Binh leads the water to the Thanh Binh B pump station.

Inundation:

Hai Duong city's inner area is 37.26 km^2, including residential land, land for construction of industrial zones and clusters, land for technical infrastructure and social infrastructure. In recent years, due to budget condition, the investment in the construction and improvement of synchronous technical infrastructure system has encountered many difficulties, while some areas are still seriously inundated. In the past years, due to weather changes abnormally, every year in the rainy season, there is inundation on large scale in Hai Duong city with a depth of 30-40cm and some areas up to 60cm; the inundation can last up to 1-2 days.

Particularly in 2016, the rain on 28 August generated the rainfall up to 158.8mm. This was a very heavy rain and rarely occurred. With the existing state of the drainage system, the city could not afford to drain the water so the inundation happened on 900ha on most of roads and residential areas in the city's wards. There were very deep flooded areas (Nguyen Luong Bang, Ngo Quyen, Cam Thuong: 60cm, east of Ngo Quyen: 30 ÷ 60cm, many new flooded areas from 20 ÷ 40cm in the east, Nguyen Thi Due, Vu Huu: 50cm, Thánh Temple: 30 ÷ 50cm, Rang Nhan: 20 ÷ 30cm. Many residential areas of Cam Thuong, Tan Binh, Thanh Binh and Binh Han wards were seriously inundated. The longest time of flooding was 48 hours in old residential areas in Tan Binh ward.

According to the annual statistics of the Hai Duong People's Committee and the Construction Management Joint Stock Company, there are 3 main flooding zones in Hai Duong city:

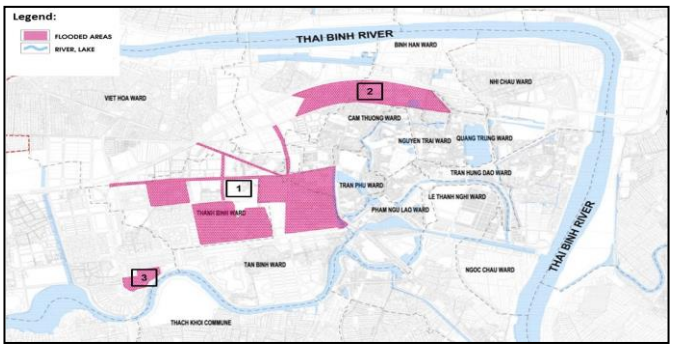


Figure 2.4: The flooded areas in Hai Duong city

Zone 1: located in the western part of the city, covers an area of about 600 hectares. This area is being developed. High urbanization reduces the area of natural watershed for water drainage. In the west of the city, there is no pond for rain water. Two types of flooding can be identified:

+ Flooding in residential areas: In this area there are new urban areas and old residential areas. The elevation in new urban areas is higher than the old ones. Water from these areas does not flow into the drainage system. In some areas, the pumping stations are not enough capacity, there is still flooding (Lo Cuong pumping station, Binh Lau pumping station…);

+ Flooding on transport routes: Water drainage network along roads with low capacity not enough to meet the requirements. This network is also old and in poor condition. Existing pipes do not work well and due to the long pipeline, the effluents to the T1 cannal are

arranged too low. Part of the drainage network has not yet been constructed. Urbanization has led to a decline in natural drainage capacity (concretization reduces the natural soil surface for water's natural penetration). There are no pond that can temporarily contain rainwater. . The main waterways for the area (Nguyen Luong Bang, Thanh Binh ...) drainage system B800 drainage does not have enough section to escape to the basin.

Zone 2: located in the north of the city, between the railway and National Highway 5, about 300ha, drain to the north and Thai Binh river through two pump stations of Dong Nien and Binh Han. Due to the low number of sewers through National Highway 5 as well as the lower ground level than the two major traffic routes of National Highway 5 and Hanoi-Hai Phong railway, the drainage of this area is difficult. In addition, the capacity of the pump stations is not enough and the location of the pump stations is too far away as well as no reservoir in front of the pump station that is also the cause of flooding.

Zone 3 is located in Tu Minh ward. This area includes new urban areas interspersed with old residential area. New urban area has higher ground level than old residential area. Therefore, the water from the old residential areas can not escape, leading to flooding.

Wastewater discharge status

Hai Duong city is using combined drainage system for both rainwater and wastewater. Wastewater from household septic tanks drains into the combined sewer system.

In the urban areas of Nguyen Trai, Pham Ngu Lao, Tran Phu, Le Thanh Nghi, Tran Hung Dao and Quang Trung, wastewater has been collected for treatment in the project of waste water collection and treatment in Hai Duong city using KFW capital, the area of collection is about 4.03 km^2 serving 50,600 people. 100% of households connected to KfW treatment system in its tentative area. The type of collection is using the sluice gates and combined sewer overflow to the Ngoc Chau water plant with designed capacity of Q = 13,340 m^3/day. The current capacity of the factory is Q = 6,000 m^3/day. However, the plant is using mechanical treatment technology and the wastewater has not been biologically treated before being discharged into Thai Binh river. In addition, the treatment plant also has a sludge treatment tank receiving sludge from the septic tank.

In the remaining wards and outskirts, no waste water collection and treatment system has been built. Household wastewater is discharged into the combined sewage system or discharged into the environment causing environmental pollution and causes of lost urban beauty. Especially in the western area of Hai Duong city, a new urban area with population up to 90,000 people and an area of about 1,900 hectares with many factories, industrial clusters…wastewater is discharged directly into the natural canals and ditches leading to the pumping station that causes serious environmental pollution, affects the health of the people.

Wastewater is discharged into natural canals in the western part of the city

Industrial zones and large industrial clusters in the city have their own waste water treatment system to ensure the quality of water before the discharge into the receiving source.

Hospital wastewater has been collected and treated in accordance with the standard of the Ministry of Health before being discharged into the city's combined drainage system.

- ❖ Existing status of household and public sanitation system in Hai Duong city

At present, up to 90.9% of households in Hai Duong city use sanitary toilets. Of which, 81.8% of households are using toilets with septic tank and 9.1% of households are using two-chamer toilets. Additionally, 100% of schools at all levels are using sanitary toilets.

2.3.5. Solid Waste Collection

The collection and transportation of solid waste in the city is handled by Hai Duong Urban Environment Joint Stock Company. There are 10 garbage collection sites in the city, of which four sites are built with gates and walls, and the rest have to gather rubbish on the streets.

The volume of solid wastes generated by each household in the city ranges from 4.8-8.3 kg/household/day, equivalent to 170 tons. The rate of collection is 80-85% of the amount of generated domestic waste. All waste will be treated at the Seraphin solid waste complex area with a processing capacity of 175 tons/day. Today, most of industrial waste in the city are contracted by business owners with environmental treatment units in accordance with regulations. Construction solid waste is collected and transported to the disposal site in Tu Minh ward.

Medical solid wastes are classified in situ for appropriate treatment. Medical waste is collected and treated 100%. Other solid wastes are collected for treatment along with domestic waste.

The city's centralized cemetery has been built, and there is a cremation method.

2.3.6. Telecommunications

The city has a complete network of post and telecommunication, ensuring service quality and meeting the demand for information and communication. Other services such as import and export, representative offices are also developed.

2.3.7. Environmental and Social Conditions at Some Project's Areas

2.3.7.1. Sub-component 1.1: Drainage and Flood Preventation

Completion of drainage system on Nguyen Luong Bang road: The project area is mainly located in Thanh Binh ward, which is the main axis of Hai Duong city linking NH5 with the central area of the city. Nguyen Luong Bang road is a double paved road with 4 lanes each, with complete infrastructure such as sidewalks, lighting, trees. The side drains and box culverts with slabs, BxH = 600x 600mm are installed along the road sides. However, sewers

are small in size and can not be dredged regularly and there is no water surface to store water. Therefore, the route is often flooded when raining. There are dense population and shops along two sides of the road with various forms from vendor to restaurant, shops…

Flooded situation on Nguyen Luong Bang road – Hai Duong city in 2016

Flooded situation on branch roads in 2016

Completion of the drainage system on Thanh Binh road: located on Thanh Binh ward, a 1.55km long road is double paved asphalt road with 2 lanes each, with complete infrastructure such as sidewalks, lighting, trees. Sewers have not been dredged for long time and due to the low altitude of the sewers, they can not collect rainwater and sewage from the eastern part of the railroad and push into the western railroad's collection system that leads to the existing frequent flooding. There are dense population and shops along two sides of the road. At the beginning of the route, there is the Hospital for Tuberculosis and Lyme diseases, and there are new villa areas about 0.5 km at the end of the route with many houses under construction and lots of empty land.

Flooded situation when the culvert is lower than road surface and it not frequently dredged

Existing status on Thanh Binh road

Figure 2.5: Map of Sub-component 1: Drainage and Flood prevention

2.3.7.2. Sub-component 1.2: Rehabilitation of drainage system in the north of the railway

Rehabilitation of drainage system in the north of the railway: To construct a system of ditches along NH5 to Nghe Lake and Binh Lau pumping station. At the two sides of NH5, there is a wastewater and rainwater collection system. However, due to the elevation of the two sides of the road is higher than the drainage system, it is impossible to connect the two systems and there is not enough capacity for drainage, that causes flooding in some areas. In addition, long-term drains are not dredged and the elevation of sluices is too low in comparison with the height of the sluice gates. -> can not collect rainwater and sewage in the eastern part of the railway and push into the western collection system. This leads to frequent inundation.

Rehabilitation of the Nghe Lake*:* located in Cam Thuong ward. In the north, it borders with the soil ditches and dikes along the south of Thai Binh river. The east side is adjacent to the brick factory and the back wall of the Han Temple and a cemetary. The South is adjacent to the back of the households on Phan Dinh Phung road. To the west, it borders with the soil road and gardens. The system of irrigation ditches to Nghe lake (along Phan Dinh Phung road) has been built for a long time, not being dredged, small size with no capable of collecting large volumes of water when there is heavy rain. Currently, there are about 600m of D600 sewer being installed on both sides of the road. The pipe size is not enough for the drainage of the basin of about 33 hectares. The lake water has signs of pollution of domestic waste water. The western side is adjacent to a land road with lots of waste being disposed indiscriminately. The lake is covered by water hyacinth and Colocasia gigantea. There are many weeds and some fruit trees like bananas, longan around the lake.

The cemetery on Nghe lake (adjoining the fence of Han pagoda)

The south of the lake adjoins back of houses on Phan Dinh Phung road. These households plant banana and fruit trees adjacent to the lake

Rehabilitation of the ditch system in the north of the railway (basin from NH5 to Thai Binh river)

Rehabilitation of the ditch system in the north of the railway (basin from NH5 to Thai Binh river). This ditch system is divided into two parts. The first part includes 3 sections as follows:

+ Section 1: To use concrete culvert system with covered slabs running along Phan Dinh Phung road, which is a densely populated area and medium traffic density.

+ Section 2: Connects with section 1 running along the fence of Cam Thuong water plant and in parallel with the dyke. There is no resident living in this area but people use the land for planting vegetables, banana and other fruit trees.

+ Section 3: Connects with 2, running in parallel with the dyke to Dong Nien pumping station. There is no resident living in this area but people use the land for planting vegetables, banana and other fruit trees.

The second part: This part begins at the south of Thai Binh river dyke, about 150m from Do Han 4-way intersection. This part is completely open channel running from East to South among Binh Han ward residential areas. The channel runs to the intersection with Dinh Van Ta road and turns to the North along Dinh Van Ta to Binh Han pumping station. The channel runs through a densely populated area and serves as the draining and receiving domestic wastewater from local households.

Rehabilitation of the drainage system in the north of the railway (basin between Ha Noi-Hai Phong railway and NH5)

One new drainage system will be constructed, beginning at the intersection between NH5 and Nguyen Thi Due road and ending at the intersection between NH5 and Thanh Nien road, with total length of 3.6km. This drainage system is expected to be an open channel system, located between the greenery corridor of NH5 with the local road. The NH5 has high traffic density of which there are many big vehicles with high speed. The local road has road surface of 5m wide, sidewalk of 3m wide and is a two-way road with medium traffic density. There are trading households along the local road.

Construction of 2 drainage pumping stations at two culverts crossing with NH5 to conduct water to Nghe lake and Binh Han pumping station:

Pumping station PS1: This pumping station will be constructed on the greenery corridor near the intersection between Pham Dinh Phung and NH5 collector road, in front of Hoang Lan Jewery shop (No.114 Phan Dinh Phung road). The traffic density on this NH5 section is high, especially there are many big vehicles with high speed. The collector road and Phan Dinh Phung road are two-way roads with medium traffic density.

Pumping station PS2*:* This pumping station will be constructed on the greenery corridor near the intersection between Quang Trung road and NH5 collector road. The traffic density on this NH5 section is high, especially there are many big vehicles with high speed. The collector road and Quang Trung road are two-way roads with medium traffic density.

Figure 2.6: Map of Sub-component 2: Rehabilitation of drainage system in the north of the railway

2.3.7.3. Sub-component 1.3: T1 cannal embankment and construction of new Lo Cuong pumping station

T1 canal embankment: 1.58 km long. The northern start point intersects with NH5. The southern end point of the route intersects with the Sat river. The majority in the west of the T1 canal is fields and land for fruit trees. About 1km from the beginning of the route, there is no road and at 0.6 km at the end of the route, there is only a small soil road. In the eastern area of the route, about 1.3 km of the beginning section is contiguous to Vu Manh Hung road, which is a paved road with two lanes on each side and about 0.3 km at the end of the route adjacents to the 3m concrete road. At the beginning of the canal, there is a small business household, along the pavement on the east side of the T1 canal, there are several main street vendors selling water. The area around 300m at the end of the line has low traffic density. Many households here make use of the space on the canal sides as drying bed for noodles. At the end of the canal that intersects the Sat river, there is aquacultural area on the Sat river. Most of water samples on the T1 canal is polluted by domestic waste water from local residents.

Lo Cuong pumping station: The Lo Cuong pumping station is located at the eastern end of the T1 canal that adjacents to the Lo Cuong Temple. The pumping station was built near the Sat river - There are fish cage farming and quinary water transport.

Figure 2.7: Map of sub-component 3- T1 canal embankment and new Lo Cuong pumping station

2.3.7.4. Sub-component 1.4: The embankment of the Bach Dang River banks (From Tam Giang bridge to the Dock)

Bach Dang river embankment: 1.4 km long, located on the territory of Ngoc Chau and Tran Hung Dao wards, starting from Tam Giang bridge to the end of the dock. There are many households living on the banks of the river. At 200m from the end point, there is a residential bridge linking Chuong Duong road with Cau Con road. On this bridge, there is a grid of trash, garbage collected temporarily at the bridge head with bad smell, river water shows signs of being polluted by waste water and domestic waste. At the end of the route, there are a dozen of households living on the boat and fishing for snails and fish.

Households catch shrimps and fishes along the Bach Dang river (near the locker)

Figure 2.8: Map of sub-component 4: The embankment of Bach Dang river banks

2.3.7.5. Sub-component 1.5: Construction of Waste Water Collection and Treatment in the west of the city

Wastewater treatment plant in the west of the city: Located on the vacant land in Tu Minh ward, adjacent to the Sat river, located about 150m from the nearest residential area, about 300m from Vu Cong Dan street.

Figure 2.9: Map of sub-component 5 - Construction of Waste Water Collection and Treatment in the west of the city

Figure 2.10: Map of WWTP contruction area

Tentative location of the WWTP

Sat river- Receiving treated wastewater from the WWTP

The access road to the WWTP starts at the junction with Vu Cong Dan road. This is an asphalt concrete road. The construction site at present is an area for gathering construction material so there are many disposal sites of construction wastes, making the road dirty and dusty. There is no residents living along the road. Sat river which is the receiving waterbody of the plant's treated effluent is the area for local people's fishing and aquacultural farming activities. Sat river water is not used for local people's daily life.

Construction area of 24 booster pumping stations:

Pumping station No. 1: The pumping station No.1 will be constructed on the sidewalk of Phan Chu Trinh road, near Nhi Chau kindergarten and local market on Nhi Chau road. This is a densely populated area


Pumping station No. 2: The pumping station No.2 will be constructed on the sidewalk of Dinh Van Ta road, near Viet A Hai Duong Furniture Company. There are sparse resident houses along the road.


Pumping station No. 3: The pumping station No.3 will be constructed on the sidewalk of Ngo Thi Nham road, at the section crossing with Phan Dinh Phung road, near Hoa Anh green bean cake shop. There are sparse resident's houses along the road.


Pumping station No. 4 : The pumping station will be constructed on the sidewalk of the collector road in the north of NH5, near Rong Vang Minh Ngoc green bean cake shop, cluster 6, Cam Thuong ward. There are sparse resident's houses along the road.


Pumping station No. 5 : The pumping station will be constructed on the sidewalk near a small pond in opposite to alley 144 of Dong Nien ward. This area is near Viet Hoa kindergarten and Dong Nien temple in Viet Hoa ward. There are sparse resident's houses along the road.


Pumping station No. 6 : The pumping station will be constructed at the junction between Viet Thang and Han Trung roads. This road area has concrete surface and no sidewalk, with many resident's houses.


Pumping station No. 7 : The pumping station will be constructed at the end of Dich Hoa road which adjoins ricefield and has low traffic density. This road is a concrete road without sidewalk. There are resident's houses along the road.


Pumping station No. 8: The pumping station No.8 will be constructed on the sidewalk of Hoa Binh lake, near the junction between Doan Nhu Hai and Thanh Nien roads. This area has low traffic density and is thinly populated.


Pumping station No. 9: The pumping station No.9 will be constructed on the vacant land area on Hong Quang extended road. This is a newly constructed double lane road with low traffic density and thinly populated.


Pumping station No. 10 : The pumping station No.10 will be constructed on the sidewalk of Tran Canh road, about 30m from Holly Hoai temple (Co Hoai temple). This area is densely populated and is on the way of rehabilitation of draiange system.


Pumping station No. 11: The pumping station No.11 will be constructed on a vacant land area, at the corner opposite to No.1 Tue Tinh road. This is a densely populated area.


Pumping station No. 12: The pumping station No.12 will be constructed on the sidewalk adjoining to the telecommunication service center (No.344 Nguyen Luong Bang road) and junction between Nguyen Luong Bang and Vu Huu roads.


Pumping station No. 13: The pumping station No.13 will be constructed on the sidewalk adjoining the house corner on Nguyen Van Linh road, at the junction between Nguyen Van Linh and Le Thanh Nghi roads. At present, this area already has wastewater collection system.


Pumping station No. 14: The pumping station No.14 will be constructed on the sidewalk of the corner between Vu Huu and Nguyen Van Linh roads, in opposite to Thanh Binh market. At present, this area already has wastewater collection system.

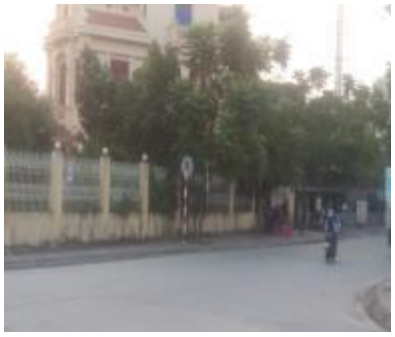

Pumping station No. 15: The pumping station No.15 will be constructed at the junction between Nguyen Van Linh road and road 30/10, at the gate corner of Petro gas station. This is a thinly populated area with low traffic density.


Pumping station No. 16: The pumping station No.16 will be constructed in alley 253 of Ngo Quyen road, at the yard corner of Tan Binh kindergarten, in opposite to the pagoda. This is a densely populated area and there are already local drainage culvert system.

Pumping station No. 17 : The pumping station will be constructed in the alley of Ngo Quyen road, in opposite to the headquarter of Tan Binh ward People's Council. This is a vacant land area where people are planting vegetables.


Pumping station No. 18: The pumping station will be constructed on the sidewalk in opposite to the house No.381 Binh Loc road. At present, this area is densely populated and is the market place for local people.


Pumping station No.19: The pumping station No.19 will be constructed on the sidewalk in opposite to the headquarter of Thanh Binh ward PC, near Truong Chinh road.




Pumping station No. 20: The pumping station No.20 will be constructed on the sidewalk of the junction between Hoang Quoc Viet and Truong Chinh roads. At present this is a vacant land area and the traffic density is low.

Pumping station No. 21: The pumping station No.21 will be constructed at the corner of a grade-4 house, in opposite to Nguyen U Di road. This is a densely populated area. The

pumping is 20m from Tu Minh kindergarten which is on the road junction. Traffic density on the road is low.


Pumping station No. 22: The pumping station No.22 will be constructed at the garden corner on the back of Cam Khuc pagoda on Thach Lam road which crosses with Pham Luan road. This is a densely populated area and is about 3m from the substation. The road has low traffic density.


Pumping station No. 23: The pumping station No. 23 will be constructed on the sidewalk adjoining the channel in opposite to resident house No. 63 Vu Duc road. This is a densely populated area with low traffic density.


Pumping station No. 24: The pumping station No. 24 will be constructed on the sidewalk near house No. 66 on Vu Cong Dan road which intersects with Thuong Dat road. At present, this is a densely populated area and is about 15m from the local market.


Following table presents typical environmental and social conditions at the project areas:

Table 2.19: Specific environmental and social conditions at the project areas

Work item	Location	Image	Description
1. Completion of drainage system on Nguyen Luong Bang road			
1.1. To complete the drainage sewer on Nguyen Luong Bang road (L=5.01 km)	Located in Thanh Binh ward, which is the main axis of Hai Duong city linking Highway 5 with the central area of the city		Sewers are small in size and are not dredged regularly and there is no water surface to store water. Therefore, the route is often flooded when raining. There are dense population and shops along two sides of the road with various forms from vendor to restaurant, shops
	Km1+500		Road to Hai Duong Medical college
	Km 1+600		Hai Duong Medical technical University

Work item	Location	Image	Description
1.2. To complete technical infrastructure on Thanh Binh road (L=3.84km)	Km0+000 - Km1+000		There are dense population and shops along two sides of the road
	Km0+000		The road passes through Hospital of Tuberculosis
	Km1+000 - Km1+550		There are new villa areas about with many houses under construction and lots of empty land.
	Km 1+550- Km 3+120		The sewer has not been dreged for a long time and was constructed at lower elevation than the collection sewers, so the collection capacity is poor in the eastern area of the railway, causing frequent inundation.
2. Rehabilitation of the drainage system in the north of the railway			
2.1 Rehabilitation of the regular lake F=2.4 ha	Area of the regular lake		Located in Cam Thuong ward. There is sign of lake water polluted by domestic wastewater. the western area is adjacent to the dirt soil where the rubbishes are discharged uncontrolledly. The lake surface is covered by hyacinth and colocasia gigantean

Work item	Location	Image	Description
	The North		Adjacent to the soil ditch and Thai Binh river southern's dyke
	The East		Adjacent to the brick factory and the back wall of Han pagoda and one cemetery.
	The South		Adjacent to the back of residents' house on Phan Dinh Phung street. Residents plant banana and fruit trees along Nghe lake
	The West		Adjacent to the dirt road and garden
2.2. Rehabilitation of the conduit ditch in the north of the NH5 to Nghe lake and Binh Han pumping station (L=4.09 km)	*Water channel from Nghe lake to Dong Nien pumping station:*		Section 1: Running along Phan Dinh Phung road, through densely populated area
			Section 2 : connecting with section 1 running along the fence of Cam Thuong water plant, in parallel with the dyke of Thai Binh riversection

Work item	Location	Image	Description
			Section 3 : connecting with section 2, running in parallel with the dyke to Dong Nien pumping station. The land along the ditch bank is used by neighboring residents for planting banana, vegetables and some kinds of fruit tree.section
	Water channel from residential area in Binh Han ward to Binh Han pumping station		This is an open channel runs along and adjoins resident houses in Binh Han ward.
2.3. Rehabilitation of the drainage system in the north of the railway (L =3.6 km)			The culvert and sewer are not dredged for a long time, the pipeline is syphon form causing poor drainage capacity
3. T1 canal embankment and construction of new Lo Cuong pumping station			
T1 canal embankment (L=1.58)	Km0+000		Small business households at the beginning of T1 canal
	Km0+000 – Km1+300		Pham Hung double-lane road and sidewalk along T1 canal

Work item	Location	Image	Description
	Km1+300 – Km1+600		Residents dry noodles on roads
Lo Cuong pumping station	Location of the pumping station		Lo Cuong pumping station is located on the end point in the east of T1 canal, adjacent to Lo Cuong temple.
	The pumping station is constructed near Sat river		There is cage fish farming activity in the area
			There is quinary navigation activities in the area.
			Residents dry noodles along the canal
4. Bach Dang river embankment (from Tam Giang bridge to the dock)- *L*=1.4 km on two wards of Ngoc Chau and Tran Hung Dao			

Work item	Location	Image	Description
	Start point from Tam Giang bridge (K0+00)		Residents living densely along two banks of the River
	Km1+200 - Km1+300		At 200m from the end point, there is a residential bridge linking Chuong Duong road with Cau Con road. On this bridge, there is a grid of trash, garbage collected temporarily at the bridge head with bad smell, river water shows signs of being polluted by waste water and domestic waste.
	Km 1+300 – Km 1+500		There is concrete road on the right bank of the Bach Dang river.
	The end point adjacent to the dock		There are dozens of resident households at the end of the dock who live on boats and make living by fishing on the river .
5. Wastewater treatment plant in the west of the city			
	Location		Located on the vacant land in Tu Minh ward, adjacent to the Sat river, located about 200m from the nearest residential area, about 500m from Vu Cong Dan street.
	Receiving waterbody		Sat river- Receiving effluent from the treatment plant The area for discharging treated wastewater from the plant is the area where there are fishing activities and aquacultural production of local people.

Work item	Location	Image	Description
	Access road		The access road is asphalt concrete road. The wastewater treatment plant will tentatively be constructed on an area which was planned to be a landfill. Therefore, there are many wastes along the access road. The road is very dirty and there is no residents living along it. .
	Buffer zone		The wastewater treatment plant will be tentatively constructed on an area which was planned to be a landfill, so there is almost no residents living in the surrounding area.

2.3.7.3. Sensitive locations in the project area

Sensitive locations in the project area include (1) Lo Cuong temple, (2) Thanh Dong University and (3) Tu Minh ward medical station; (4) Han pagoda in Cam Thuong ward, (5) Kim Chi pagoda, (6) Tuberculosis & Lung Disease Hospital, (7) Hai Duong Medical College and (8) Hai Duong Medical Technical University Hospital belongs to Thanh Binh ward.

Table 2.20: List of sensitive locations in the project area

No	Name / Photo	Items	Distance to site (m)	Separate described
1	Lo Cuong temple 	Lo Cuong pumping station; about 30 m from T1 canal embankment	Adjacent to the project area of the Lo Cuong pump station ; about 30 m from T1 canal embankment	Lo Cuong temple is in Tu Minh ward, located on the bank of the Sat river, faces the Sat river, the back is adjacent to Vu Manh Hung concrete road. This area has low traffic density.
2	Thanh Dong university 	T1 canal embankment; Construction waste line	Approximately 300m from the project area of the T1 canal embankment and 250m from the disposal site for construction waste.	Thanh Dong University is located on Vu Cong Dan road, which is the main transportation route for construction waste with low traffic density. The school has a large campus with many green trees, the main campus of the

No	Name / Photo	Items	Distance to site (m)	Separate described
				school about 60m from the road. The area around the school is field.
3	Medical station Tu Minh ward 	T1 canal embankment; Construction waste line	Approximately 300m from the project area of the T1 canal embankment and 350m from the construction waste site.	Tu Minh health station is 50m from Vu Cong Dan road, with green trees. The area around this area is field
4	Hàn pagoda (Cuc Lac pagoda) 	Rehabilitation of the Nghe Lake	Adjacent to the Nghe lake	In the East of Nghe lake
5	Cemetary 	Rehabilitation of the Nghe Lake	Adjacent to the Nghe lake	In the East of Nghe lake
6	Kim Chi pagoda 	Thanh Binh road	400 m	Kim Chi Pagoda is located on Nguyen Van Linh road with average traffic density and material transport and discharge route of Thanh Binh road project..
7	Tuberculosis & Lung Disease Hospital 	Thanh Bình street	Adjacent to Thanh Bình street	The Tuberculosis & Lung Disease Hospital is located on Thanh Binh road, which is one of the main roads of the city with medium traffic density.
8	Hai Duong Health College	Nguyen Luong	Entrance is	The road to Hai

No	Name / Photo	Items	Distance to site (m)	Separate described
		Bang road	located on Nguyen Luong Bang road	Duong Medical College is located on Nguyen Luong Bang road, which is the main road linking the city center to Highway 5, with high traffic density.
9	Hai Duong Medical Technical University Hospital 	Nguyen Luong Bang road	Adjoin Nguyen Luong Bang road	Hai Duong Medical Technical University Hospital is located on Nguyen Luong Bang road, the main road linking the city center to Highway 5, with high traffic density.
10		Pumping station No. 1, on Phan Chu Chinh road	50	Nhi Chau kindergarten. This is a densely populated area. Many households along the road are selling food, grocery
11		Pumping station No. 5, nằm trên đường Đồng Niên	35	Dong Nien temple. The pumping station will be located on the sidewalk adjoining a small pond in the densely populated area .
12		Pumping station No. 5 on Dong Nien road	10	Viet Hoa kindergarten. The pumping station is tentatively located on the sidewalk near a small pond in a densely populated area.
13		Pumping station No. 10, on Tran Canh road	30	Holly Hoai Temple. This is a densely populated area where the drainage system is under rehabilitation process

No	Name / Photo	Items	Distance to site (m)	Separate described
14		Pumping station No. 14, located at the junction of Vu Huu road and Nguyen Van Linh road	20	Thanh Binh market. The tentative location of the pumping station is on a wide sidewalk of Vu Huu road, facing Thanh Binh market and its back adjoins a vacant land area
15		Pumping station No. 16, located in alley 253, Ngo Quyen road	1	Tan Binh kindergarten. The tentative location of the pumping station is on the sidewalk, adjoining fence of Tan Binh kindergarten. This is a densely populated area.
16		Pumping station No. 21 on Nguyen U Di road	20	Tu Minh Kindergarten. This is a densely populated area, there are some hosueholds selling food and grocery
17		Pumping station No. 22, at the junction between Thach Lam road and Pham Luan road	2	Cam Khuc pagoda. This is a densely populated area, about 3m from the substation
18		Pumping station No. 24 on Vu Cong Dan road	15	Local market. Tentative construction area is on sidewalk of Vu Cong Dan road, which is a densely populated area.

CHAPTER 3. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

The project consists of two components: (i) Component 1: Improvement of Infrastructure and Environmental Sanitation; (ii) Component 2: Technical Assistance and Investment Implementation. Component 2 is non-structural component so it would not cause negative environmental and social impacts. Basing on the analysis of baseline environment, field surveys and discussion with stakeholders, possible negative physical, biological, socio-economic and environmental impacts of the project have been identified for Component 1 in all three phases (pre-construction, construction and operation) of the project.

3.1. Environmental Impact Assessment

3.1.1. Positive Impacts

In general, the proposed subproject would bring about significant positive impacts to Hai Duong City. Local people will be benefited from a healthier and sustainable living environment. Among others, the positive impacts include: (i) improved environmental conditions and urban landscape in many public and residential areas; (ii) increased wastewater collection and treatment; (iii) minimized discharge of untreated wastewater into the environment; (iv) reduction of public health risks associated with water-born diseases and related healthcare cost; (v) reduction of traffic jam or safety risks caused by inundation; (vi) increased the accessibility of local people to nearby areas. The specific benefits of the subproject are described in more details below:

- Completion of the drainage system on Nguyen Luong Bang and Thanh Binh roads through the installation of waste water and rainwater pipes on both sides of the road will help reduce flodding in the residential areas and inundation on the roads in the Western part of the city.
- Rehabilitation of the ditch system along NH5 and construction of Lo Cuong pumping will help reduce inundation in the residential areas and inundation on the road in the North of the railway
- Embankment of Bach Dang river and T1 canal and rehabilitation of Nghe lake will help improve the environment, open and ensure the flow, connection, raise drainage capacity and erosion prevention.
- Thoroughly solve the situation of canal encroachment, and illegal direct waste disposal and discharge along canal banks.
- Tree planting along the constructred would create good landscapes, improve the air environment, and increase the coverage of trees in the city.
- Building the 12,000 m^3/day WWTP will improve sanitation conditions for the community, reduce the risk of water-borne diseases to improve health and living conditions by improving drainage system in the west of the city.
- Strengthen the resilience to climate change by improving drainage capacity, reinforce the soil at construction sites, follow the design and standards of climate change adaptation, increase greenery space in the city.
- The direct beneficiaries of the project are 124,020 people, including: 28,328 people of Thanh Binh and Viet Hoa wards; 46,923 people of Cam Thuong, Binh Han, Nhi Chau and Viet Hoa wards; 14,176 People of Tu Minh ward; 34,593 people of Ngoc Chau, Pham Ngu Lao, and Tran Hung Dao Ward.

Thus, with the synchronous investment of the project, Hai Duong city will have positive changes; the urban aesthetics are improved, and the environmental conditions are sustainable; It will contribute to promoting economic development, which will be the driving force for the

city to develop comprehensively in all aspects, from economy, culture to education, and the living standards of the people will be improved.

3.1.2. Potential Negative Impact

3.1.2.1. Type and Scope of Impact

Based on the analysis of the baseline data, field visits, and consultation with the key stakeholders and the affected communities, the potential negative impacts on the natural and socio-economic environment of the subproject have been identified. These assessments are detailed in this chapter of the report.

The negative impacts on the environment and society are related to the civil works of Component 1, of which most of these impacts are site-specific, reversible, temporary, localized and could be mitigated through the application of good engineering and construction management practices and with close supervision and monitoring of contractor performance and consultation with local communities. However, the type and nature of the impacts vary with the nature and scale of the activities, locations, and their environmental and social settings, human behaviors, and time factors.

Potential environmental impacts are classified and identified in Table 3.1 below, of which: None (N) – No impacts; Low (L): Small work, small impacts, localized, reversible, temporary; Medium (M) – Small works in sensitive/urban areas, medium-scale with medium impacts, reversible, temporary; High (H) – Major works in sensitive/urban areas, large-scaled works with significant impacts (social and/or environmental), irreversible, and compulsory compensation.

Table 3.1: Potential negative impact of the project

Component	Physical			Biological		Social				Others	
	Air noise, vibration	**Land, Soil, water**	**Solid waste, sludge**	**Forest, natural habitats**	**Fish, aquatic species**	**Land acquisition, resettlement**	**Indigenous people**	**Physical cultural resources (PCR)**	**Livelihood, community disturbance**	**Localized floods, traffic, safety**	**Offsite Impact**
Sub-component 1.1: Drainage and flood prevention - Complete the drainage system on Nguyen Luong Bang road with the length of L = 5.01 km with the system of diameters of D600 to D1500 cm round culverts. - Complete drainage system on Nguyen Luong Bang road with a length of L = 3.84 km with D1,000 to D2,000 round culvert - Social impacts: No households will be affected and relocated - Sensitive receptors: Hai Duong Medical College (70 m from Nguyen Luong Bang road); Hai Duong Tuberculosis and Lung Disease Hospital (adjoining Thanh Binh road) and Hai Duong Medi-Tech Universtiy Hospital (Adjoining Nguyen Luong Bang road)										
Pre-construction	N	N	N	N	N	N	N	N	M	N	N
Construction	M	M	M	N	L	L	N	L	L	M	M
Operation	N	N	L	N	N	N	N	N	N	L	N
Comments	- Impacts of low or medium levels from construction operations can be mitigated with ECOPs. (see 2nd note below) - Pre-construction stage: (i) Risk of UXO; - Construction stage: (i) Local flooding; (ii) Transport hinderance and impacts on business activities; (iii) Impacts to PCRs and sensitives receptors: - Operation stage: (i) Risks of flooding from lack of O/M;										
Sub-component 1.2: To rehabilitate the rain water drainage system in the north of the railway - Construct Nghe Lake as the compensating lake, area F =2.4ha; - Rehabilitate the ditch system BxH =600x600 – BxH = 10000 x4000 to conduct water (L = 4.09km); - Rehabilitate drainage system in the North of the railway: Construct open channel system, BxH = 800x80 – BxH =2000x2000 along 7 sewer locations on NH5, L = 3.6 km, and construct two booster pumping stations along NH 5 with capacity Q1=2.7m^3/s and Q2 =1.28m^3/s. - Social impacts: There are about 2 affected households and there are not households have to relocate their houses;49.93 m^2 residential land is recovered. - Sensitive receptor: one cemetary locates in the east of Nghe lake										
Pre-construction	N	N	N	N	N	L	N	N	M	N	N
Construction	M	M	M	N	L	L	N	M	M	M	M
Operation	N	N	L	N	N	N	N	N	N	L	N
Comments	- Impacts of low or medium levels from construction operations can be mitigated with ECOPs. (see 2nd note below) - Pre-Construction stage: (i) Risk of UXO; (ii) Impacts from land acquisition and resettlement - Construction Stage: (i); Local flooding (ii) Impact on Aquatic systems; (iii) Impacts to PCRs and sensitives receptors: - Operation Stage: (i) Water pollution and decreased lanscape due to direct waste disposal into Nghe regular lake; (ii) Embankment subsidence risk during operation of Nghe regular lake; (iii) Risk of local flooding due to the poor operation and maintenance; (iv) Risks from the Open Channel System										

Component	Physical			Biological		Social				Others	
	Air noise, vibration	**Land, Soil, water**	**Solid waste, sludge**	**Forest, natural habitats**	**Fish, aquatic species**	**Land acquisition, resettlement**	**Indigenous people**	**Physical cultural resources (PCR)**	**Livelihood, community disturbance**	**Localized floods, traffic, safety**	**Offsite Impact**
Sub-component 1.3: T1 canal embankment and construction of new Lo Cuong pumping station - Dredge and line embankment for T1 canal banks (section from Nguyen Luong Bang to Sat river (L = 1.58km)); - Construct Lo Cuong pumping station with capacity Q = 11m^3; - There will be about 10 affected households and 1 afffected agency. No households will be relocated; 455 m^2 pond land; 1545 m^2 cannal land is recovered. - Impacts on PCRs include: Lo Cuong Temple (30 m from T1 cannal);										
Pre-construction	N	N	N	N	N	L	N	N	M	N	N
Construction	M	M	M	N	L	L	N	M	M	M	M
Operation	N	N	L	N	N	N	N	N	N	L	N
Comments	Impacts of low or medium levels from construction operations can be mitigated with ECOPs. (see 2nd note below) Pre-Construction stage: (i) Risk of UXO; (ii) Impacts from land acquisition and resettlement Construction Stage: (i); Impacts on inland waterway (ii) Impact on aquacultural production; (iii) impacts on agricultural land and fruit-tree plantation (iv) Risks on Soil Erosion, Embankment Subsidence, and House Damage during Embankment (v) Impacts to PCRs and sensitives receptors; Operation Stage: (i) Water pollution and decreased lanscape due to direct waste disposal into T1 cannal; Bad odor; Embankment subsidence risk during operation of T1 Canal										
Sub-component 1.4: The embankment of the Bach Dang river banks (from Tam Giang Bridge to the Dock) - Line the embankment for Bach Dang river banks from Tam Giang to the Dock (L =1.4km), construct one management road from 2- 4m wide. - There are about 78 affected households, in which 2 affected households are vulnerable; 23.81 pond land and 618.17 residential land is acquired.											
Pre-construction	N	N	N	N	N	M	N	N	M	N	N
Construction	M	M	M	N	L	L	N	M	M	M	M
Operation	N	N	L	N	N	N	N	N	N	L	N
Comments	-Impacts of low or medium levels from construction operations can be mitigated with ECOPs. (see 2nd note below) -Pre-Construction stage: (i) Risk of UXO; (ii) Impacts from land acquisition and resettlement ; - Construction Stage: (i); Impact on Ecosystem and Mollusca Output (ii) Landslide on Bach Dang river banks; (iii) Impact on local bridge (iv) Disruption of business activities - Operation Stage: (i) Water pollution and decreased lanscape due to direct waste disposal into Bach Dang cannal; (ii) Embankment subsidence risk during operation										
Sub-component 1.5: Construction of wastewater collection and treatment system in the west of the city - Construction of the separate sewer system for rainwater and wastewater, total length of the D300-D600 sewer =127.1km (2) Construction of 24 booster pumping stations with capacity from Q= 238 m^3/day to Q=12,000 m3/day and forced pipeline D300-D600 with L= 1.53 km; (3) Construction of wastewater treatment plant with capacity Q=12,000 m^3/day by 2025. - 5000 m^2 landfill is recovered.											

Component	Physical			Biological		Social				Others	
	Air noise, vibration	**Land, Soil, water**	**Solid waste, sludge**	**Forest, natural habitats**	**Fish, aquatic species**	**Land acquisition, resettlement**	**Indigenous people**	**Physical cultural resources (PCR)**	**Livelihood, community disturbance**	**Localized floods, traffic, safety**	**Offsite Impact**
- Impacts on PCRs include: Dong Nien temple (35m from Booster pumping station No. 5); Co Hoai temple (30 m from Booster pumping station No. 10); Cam Khuc Pagoda (22 m from Booster pumping station No. 22); - Sensitive receptors: Thanh Dong university (150 m from the WWTP); Nhi Chau kindergarten (50 m from Booster pumping station No. 1); Viet Hoa kindergarten (10 from Booster pumping station No. 5); Tan Binh kindergarten (1 m from Booster pumping station No. 16); Tu Minhkindergarten (20 m from Booster pumping station No. 21); - Local market (15 m from Booster pumping station No. 24).										
Pre-construction	N	N	N	N	N	H	N	N	M	N	N
Construction	M	M	M	N	L	L	N	M	M	M	M
Operation	N	N	L	N	N	N	N	N	N	L	N
Comments	- Impacts of low or medium levels from construction operations can be mitigated with ECOPs. (see 2nd note below) - Pre-Construction stage: (i) Risk of UXO; (ii) Impacts from land acquisition - Construction Stage: (i) Impact on Ecosystem and Fishery Output (ii) Impact on the PCRs ; (iii) Impact on Existing Infrastructure - Operation Stage: (i) Bad Odor from the WWTP and Pumping Station (i) Noise from Pumping Stations; Impacts on Water quality of Receiving Waterbody; Aerosols Dispersed from the WWTP; Domestic Waste from the WWTP; Wastes from Pumping Stations; Traffic Safety										

Note:

(1) The following criteria will be used to assess the level of impacts: No (N) -No impact; Low (L) – small works, small impact, locally, have resilience, temporary; Medium (M) - small works in the urban area / sensitivity, the average scale works to moderate the impact of which most can restore, minimize, and easy to manage, locally sets, temporary; High (H) - The average size of projects in small urban areas / sensitive, large-scale projects with significant impact (social and / or environmental) impacts which are unable to recover and claim; Both the M and H should supervise and implement mitigation measures as well as institutional capacity sufficient to ensure safety.

(2) The small and medium-scale projects, most of the impact is happened locally, temporary, and can be mitigated through the application of engineering and construction management work well together with surveillance and strictly monitoring and closely consultation with the local community

(3) Affected households (AHs) including people whose land are compulsorily acquired, leading to:

- Displacement or loss of houses;
- Loss of assets or loss of access to these assets;
- Loss of income sources or livelihood means, regardless displaced or non-displaced households; and Disturbance to daily life and habit.

3.1.3. Impact Assessment of Component 1

The civil works under Component 1 include:

- Sub-component 1.1: (1)Completion of 5.01 km of drainage system of diameters from 600-1,500 mm on Nguyen Luong Bang Road, (2) Installation of round converts of diameter D2000 of along the two sides of 3.84 km of Thanh Binh road.
- Sub-component 1.2: (1) Rehabilitation of Nghe regulating lake with an area of F=2.4 ha including: dredging and lining the embankment for the lake with precast reinforced concrete slabs, slope 1:1; and constructing the operation road with width of 3m around the lake.; (2) Construction of the ditch system BxH =600x600 – BxH = 10000 x4000 to conduct water (L = 4.09km); (3) Construction of open channel system, BxH = 800x80 – BxH =2000x2000 along 7 sewer locations on NH5, L = 3.5km; construct two booster pumping stations along NH5 with capacity Q1=2.7m^3/s and Q2 =1.28m^3/s.
- Sub-component 1.3: (1) Dredging, embankment for T1 canal banks (section from Nguyen Luong Bang to Sat river (L = 1.58km)) construct one management road from 3m wide.; (2) Construction of Lo Cuong pumping station with capacity Q = 11m^3/s;
- Sub-component 1.4: (1) Dredging, embankment for Bach Dang river banks from Tam Giang to the Dock (L =1.4km), construct one management road from 2- 4m wide.
- Sub-component 1.5: (1) Construction of the separate sewer system for rainwater and wastewater, total length of the D300-D600 sewer =127.1km (2) Construction of 24 booster pumping stations with capacity from Q= 238 m^3/day to Q=12,000 m^3/day and forced pipeline D300-D600 with L= 1.53 km; (3) Construction of wastewater treatment plant with capacity Q=12,000 m^3/day by 2025.

3.1.3.1. Impact during Pre-construction phase

Land Acquisition and Resettlement

It is expected that a total of 7,691.91 m^2 of land will be acquired, including 668.1 m^2 of residential land; 478.81 m^2 of pond land; 1,545 m^2 of cannal land under CPC'management and, and 5,000 m^2 of landfill under management of Hai Duong City Transport Company. 90 households will be affected by acquisition of residential land, pond land and fixed assets. There are two vulnerable households (one policy household and one poor household). 15 business households will be affected under the construction of the Bach Dang river embankment item. No ethnic minority household will be affected. The detailed impact assessment for land acquisition and resettlement under this component is given in Section – Social Impact Assessment.

Remaining Unexploded Ordnance (UXO)

The subproject construction sites have been much affected by human activities including extensive urban development, and UXOs have already been cleared. However, there can be remaining UXOs from the war time, which can be encountered during excavation. Consequences can be serious, causing injuries, losses of human life and assets in the subproject areas. Therefore, UXO detection and clearance must be carried out before commencement of any construction work.

3.1.3.2. Impact during Construction Phase

General Environmental Impact Assessment during Construction

(1) Impacts on Air Environment

The impacts on the air environment include generation of dust and emissions such as NOx, SO_2, CO, VOC from excavation, ground leveling, surface cleaning; dust and exhaust gases from the operation of transportation vehicles, the operation of construction equipment. In addition, the air can be polluted by bad odors from the amount of sludge generated during the dredging of T1 canal and Nghe Lake. However, these impacts are not continuous and in a short time, mostly temporary.

a. Dust and Emissions

Dust arising from excavation and filling activities

The construction process will include earthwork (stripping of topsoil and excavation of soil) for installation of the water drainage system and lying of underground technical infrastructure. A number of machines and equipment such as excavators, rollers, hoes, shovels, etc.…will be used, of which the operation will generate dust and emissions. Based on the formula for calculating the dust emission factor determined in accordance with the World Bank's Environmental Assessment Guide (Environment Assessment Sourcebook, Volume II, sectoral guidelines, environment, World Bank, Washington DC, 8/1991) and AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources as follows:

$$E = k \times 0.0016 \times (U/2.2)1.4 \div (M/2)1.3, \text{ kg/ton}$$

Of which: E: Pollution Factor (kg/ton);

k: Particle structure having average value (k = 0.35 with dust size <10μm – Table of Particle size (k) page 13.2.4-4 AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources);

U: Average wind speed (m/s) (wind speed 2.4m/s);

M: The average moisture content of demolished material, excavated soil, backfilling soil (%)

(Choosing an average moisture content of 11% - Table 13.2.4-1 AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, and Volume 1: Stationary Point and Area Sources). Determination of dust emission coefficient, calculation of dust pollution coefficient in construction period under Component 1 is E = 0.02745 kg/ton. The amount of dust generated by excavation and demolition work from the project area is shown in the table below:

Table 3.2: The amount of dust generated by earthwork

Items	Volume of demolition, excavation, backfilling and leveling (m^3)	Dust emission (kg)	Duration (month)	Dust load (kg/day)	Dust concentration (mg/m^3)
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	54,040	2,441	18	4.52	157

Items	Volume of demolition, excavation, backfilling and leveling (m^3)	Dust emission (kg)	Duration (month)	Dust load (kg/day)	Dust concentration (mg/m^3)
Rehabilitation of drainage system in the north of the railway	201,921	6,641	18	12.3	427
T1 canal embankment and construction of new Lo Cuong pumping station	49,600	2,135	18	3.95	137
Embankment on two banks of Bach Dang river	61,740	2,822	18	5.23	181
Construction of the wastewater collection and treatment system in the West of the city	581,135	28,719	24	39.89	1.85

Dust arising from demolition, excavation, backfilling and leveling spreads on a large area so the surface diffusion model can be used to calculate the concentration of gas emission. With an average wind speed of 2.4 m/s; distance (L(m) = W(m)) from the dust source is from 10-15 m and the height (H) from 1.5-9.0, the concentration of dust dispersed from the items by excavation and filling as follows:

Table 3.3: Concentration of dust generated from the work items due to excavation and filling activities

Work item	L(m)= W (m)	Concentration of dust (mg/m^3)							QCVN 05:2013/BTNMT (Average 1h) (mg/m^3)
		H=1.5	H=3	H=6	H=9	H=12	H=15	H=18	
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	10	4.36	2.18	1.09	0.73	0.55	0.44	0.36	0.3
	50	0.87	0.44	0.22	0.15	0.11	0.09	0.07	
	100	0.44	0.22	0.11	0.07	0.05	0.04	0.04	
	150	0.29	0.15	0.07	0.05	0.04	0.03	0.02	
Rehabilitation of drainage system in the north of the railway	10	11.86	5.93	2.97	1.98	1.48	1.19	0.99	0.3
	50	2.37	1.19	0.59	0.40	0.30	0.24	0.20	
	100	1.19	0.59	0.30	0.20	0.15	0.12	0.10	
	150	0.79	0.40	0.20	0.13	0.10	0.08	0.07	
T1 canal embankment and construction of new Lo Cuong pumping station	10	3.81	1.91	0.95	0.64	0.48	0.38	0.32	0.3
	50	0.76	0.38	0.19	0.13	0.10	0.08	0.06	
	100	0.38	0.19	0.10	0.06	0.05	0.04	0.03	
	150	0.25	0.13	0.06	0.04	0.03	0.03	0.02	
Embankment on two banks of Bach Dang river	10	5.04	2.52	1.26	0.84	0.63	0.50	0.42	0.3
	50	1.01	0.50	0.25	0.17	0.13	0.10	0.08	
	100	0.50	0.25	0.13	0.08	0.06	0.05	0.04	
	150	0.34	0.17	0.08	0.06	0.04	0.03	0.03	
Construction of the wastewater collection and treatment system in the West of the	10	38.47	19.24	9.62	6.41	4.81	3.85	3.21	0.3
	50	7.69	3.85	1.92	1.28	0.96	0.77	0.64	
	100	3.85	1.92	0.96	0.64	0.48	0.38	0.32	
	150	2.56	1.28	0.64	0.43	0.32	0.26	0.21	

Work item	L(m)= W (m)	Concentration of dust (mg/m^3)							QCVN 05:2013/BTNMT (Average 1h) (mg/m^3)
		H=1.5	H=3	H=6	H=9	H=12	H=15	H=18	
city									

Comment:

- For Nguyen Luong Bang and Thanh Binh roads: the dust concentrations vary from 4.36 to 0.73 mg/m^3 (while allowable limit is 0.3 mg/m^3).

- For rehabilitation of the drainage system in the north of the railway: Dust concentrations vary between 11.86-1.98 mg/m^3 (while allowable limit is 0.3 mg/m^3).

- For T1 canal embankment and construction of new Lo Cuong pumping station: Dust concentrations vary between 3.81 - 0.64 mg/m^3 (while allowable limit is 0.3 mg/m^3).

- For embankment on two banks of Bach Dang river: Dust concentrations vary between 5.04 - 0.84 mg/m^3 (while allowable limit is 0.3 mg/m^3).

- For construction of the wastewater collection and treatment system in the West of the city: Dust concentrations vary between 5.04 - 0.84 mg/m^3 (while allowable limit is 0.3 mg/m^3).

Data in the mentioned above table shows that, within a distance of 10 m and a height of 1.5 m from the site, the generated dust concentration is 5-100 times higher than allowable limit. This amount of dust is mostly precipitated dust so they are quickly deposited on the ground. The dust concentration in the air will decrease rapidly along with the distance from the construction site, with distance of 50m from the construction site, the dust concentration only exceeds 3-10 times compared with the allowable limit in QCVN 05: 2013/ BTNMT. As construction sites are close to residential areas, the amount of dust generated will directly affect the project area residents and construction workers at the site and traffic participants on Nguyen Luong Bang and Thanh Binh roads. During the rainy season, dust concentrations will decrease 1.5 to 2 times compared with the concentration in dry season because high humidity can promote dust precipitation. Households, sensitive receptors and PCRs (Table 3.4) located within 1-150 m from construction site will be affected by dust emissions from excavation and demolition. The level of impact can be assessed as moderate.

Table 3.4: Sensitive receptors and scale of impacts by dust from demolition, excavation and backfilling during project construction

No	Work item	Affected structure	Distance to construction site (m)
1	Infrastructure on Nguyen Luong Bang and Thanh Binh roads	Hai Duong Medical College	50
		Hai Duong Medical Technical University Hospital	Adjacent to the construction site
		Hai Duong Medical Technical University Hospital	Adjacent to the construction site
		Residents on both sides of the route and on the road	100
2	Rehabilitation of drainage system in the north of the	Han Pagoda	Adjacent to the construction site
		Cemetary	Adjacent to the construction site

No	Work item	Affected structure	Distance to construction site (m)
	railway	People near the construction site and on the road	150
3	T1 canal embankment and construction of new Lo Cuong pumping station	Lo Cuong temple	Adjacent to the construction site
		People near the construction site and on the road	100
4	Embankment on two banks of Bach Dang river	People near the construction site and on the road	150
5	Construction of the wastewater collection and treatment system in the West of the city	Thanh Dong University	150

Dust arising from transportation

According to established standards of the World Health Organization (WHO) (Assessment of Sources of Air, Water and Land Pollution –Part 1: Rapid Inventory Techniques in Environmental Pollution, WHO, 1993), 15-tons diesel trucks will generate1.6 g/ km/truck; 3.7 g/km/truck; 7.43 g/km/truck; 24.1 g/km/truck; 3 g/km/truck of dust, CO, SO_2, NO_2 and HC emissions, respectively (Sulfur content in diesel is about 0.05% S). The project will use 15 ton trucks for transportation. The average distance from construction site ranges from 18 to 23 km. Based on the formula of Air Chief, US Department of the Environment, 1995, dust load generated by transportation of excavated and backfilled material and waste disposal is calculated as in following table:

Table 3.5: Generated dust load from the transportation of excavated and backfilled materials for project work items

The name of construction	Transportation time (month)	Number of vehicles (trip/day)	Distance (km)	Generated dust load (kg/km.day)	Generated dust load (mg/m.s)
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	18	20	20	14.14	0.491
Rehabilitation of drainage system in the north of the railway	18	45	18	31.80	1.104
T1 canal embankment and construction of new Lo Cuong pumping station	18	12	23	8.48	0.294
Embankment on two banks of Bach Dang river	18	14	15	9.89	0.344
Construction of the wastewater collection and treatment system in the West of the city	24	21	18	14.84	0.515

To calculate the concentration of dust generated by means of transport at different distances and heights, the diffusion model of the source contamination according to Sutton's modified model is

applied. The results of calculating the concentration of pollutants in the emission by distance are shown in Table 3.6.

Table 3.6: Dust concentration due to transportation of excavated materials, land fillings of construction items

The name of construction	L(m)= W (m)	Concentration of dust (mg/m^3)					QCVN 05:2013/BTNMT (Average 1h) (mg/m^3)
		H=1	H=2	H=3	H=4	H=5	
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	5	0.156	0.098	0.045	0.015	0.004	0.3
	10	0.107	0.089	0.066	0.043	0.025	
	20	0.067	0.063	0.056	0.048	0.040	
	25	0.058	0.055	0.051	0.045	0.039	
Rehabilitation of drainage system in the north of the railway	5	0.352	0.221	0.101	0.034	0.008	0.3
	10	0.240	0.200	0.149	0.098	0.057	
	20	0.152	0.142	0.127	0.109	0.089	
	25	0.130	0.124	0.114	0.102	0.088	
T1 canal embankment and construction of new Lo Cuong pumping station	5	0.094	0.059	0.027	0.009	0.002	0.3
	10	0.064	0.053	0.040	0.026	0.015	
	20	0.040	0.038	0.034	0.029	0.024	
	25	0.035	0.033	0.030	0.027	0.024	
Embankment on two banks of Bach Dang river	5	0.110	0.069	0.031	0.010	0.003	0.3
	10	0.075	0.062	0.046	0.030	0.018	
	20	0.047	0.044	0.040	0.034	0.028	
	25	0.040	0.039	0.036	0.032	0.027	
Construction of the wastewater collection and treatment system in the West of the city	5	0.164	0.103	0.047	0.016	0.004	0.3
	10	0.112	0.094	0.069	0.046	0.027	
	20	0.071	0.066	0.059	0.051	0.042	
	25	0.061	0.058	0.053	0.048	0.041	

Comment:

- For Nguyen Luong Bang and Thanh Binh roads: the dust concentrations vary from 0.156 to 0.04mg/m^3 (while allowable limit is 0.3 mg/m^3)

- For rehabilitation of the drainage system in the north of the railway: Dust concentrations vary between 0.352 to 0.008mg/m^3 (while allowable limit is 0.3 mg/m^3).

- For T1 canal embankment and construction of new Lo Cuong pumping station: Dust concentrations vary between 0.094 to 0.002mg/m^3.

- For embankment on two banks of Bach Dang river: Dust concentrations vary between 0.094 to 0.002 mg/m^3 (while allowable limit is 0.3 mg/m^3).

- For construction of the wastewater collection and treatment system in the West of the city: Dust concentrations vary between 0.164 to 0.004 mg/m^3 (while allowable limit is 0.3 mg/m^3).

Thus, the concentration of dust generated from the transportation of excavated and backfilled material from the baseline environmental concentration is almost within the permissible standard limit of QCVN 05: 2013/BTNMT - National technical standard for Ambient Air Quality. Only for the work item of rehabilitation of drainage system, the dust increases slightly, about 1.17 times higher than allowable limit. However, it must be noted that the amount of dust generated may be significant owing to the mobilization of machinery and vehicles on the construction site. At some points of time, relatively large amounts of dust may abruptly increase when a large number of machines and vehicles are mobilized for necessary construction tasks. The tentative routes for transportation of wastes are main roads such as NH5, Truong Chinh, Ngo Quyen, Thanh Nien, Bui Thi Xuan and Thuong Dat. The results of air quality analysis in Chapter 2 shows that the air quality in these areas is currently fairly good. Therefore, the subproject impacts of dust would be visible. The receptors affected by dust would be the residents living along the routes. Dust pollution would hinder businesses and services located along the routes leading to a drop in the number of customers. However, these impacts can be fully controlled and minimized if all necessary mitigation measures would be carried out during construction. The impact level of dust during transportation is there by assessed as being medium, only happen during the 18-month to the 24 month construction period.

Gas emission from operation of transportation vehicles

The fuel used for the transport means as well as construction machinery and equipment is mainly DO so their operation will emit pollutant gases such as NOx, SO_2, CO. Given the assumption that, the vehicle for transportation of excavated and backfilled material has capacity of 10m^3 and fuel consumption capacity of 0.4 liter oil/vehicle.km. (1 liter of DO =0.832 kg), we can calculate the loads of NOx, SO_2 and CO generation as follows:

Table 3.7: Fuel consumption and gas emissions from vehicles transporting excavated and backfilled material during the construction

Work items	Fuel consumption (kg/day)	Load of SO_2 generation (mg/m.s)	Load of NO_2 generation (mg/m.s)	Load of CO generation (mg/m.s)
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	133.12	0.000647	0.002843	0.000012
Rehabilitation of drainage system in the north of the railway	269.57	0.001456	0.006396	0.000026
T1 canal embankment and construction of new Lo Cuong pumping station	91.85	0.000388	0.001706	0.000007
Embankment on two banks of Bach Dang river	69.89	0.000453	0.001990	0.000008
Construction of the wastewater collection and treatment system in the West of the city	125.80	0.000679	0.002985	0.000012

From the above pollution loads from exhaust gases, by applying Sutton model with a wind speed of 2.4 m/s, and a distance of 5-25 m from generating sources, the concentration of pollutants created by transportation operations can be calculated as follows:

Table 3.8: Concentration of SO_2 from the transportation of the excavated and backfilled material during construction phase

Work item	L(m)= W (m)	SO_2 concentration (mg/m^3)					QCVN 05:2013/BTNMT (Average 1h)(mg/m^3)
		H=1	H=2	H=3	H=4	H=5	
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	5	0.048656	0.048579	0.048509	0.048470	0.048455	0.35
	10	0.048591	0.048567	0.048537	0.048507	0.048483	
	20	0.048539	0.048533	0.048524	0.048514	0.048502	
	25	0.048526	0.048523	0.048517	0.048510	0.048502	
Rehabilitation of drainage system in the north of the railway	5	0.048914	0.048741	0.048583	0.048494	0.048461	0.35
	10	0.048766	0.048714	0.048646	0.048579	0.048525	
	20	0.048650	0.048637	0.048617	0.048593	0.048567	
	25	0.048621	0.048613	0.048601	0.048585	0.048566	
T1 canal embankment and construction of new Lo Cuong pumping station	5	0.048574	0.048528	0.048486	0.048462	0.048453	0.35
	10	0.048534	0.048520	0.048502	0.048484	0.048470	
	20	0.048503	0.048500	0.048495	0.048488	0.048481	
	25	0.048496	0.048494	0.048490	0.048486	0.048481	
Embankment on two banks of Bach Dang river	5	0.000144	0.000090	0.000041	0.000014	0.000003	0.35
	10	0.000098	0.000082	0.000061	0.000040	0.000023	
	20	0.000062	0.000058	0.000052	0.000045	0.000037	
	25	0.000053	0.000051	0.000047	0.000042	0.000036	
Construction of the wastewater collection and treatment system in the West of the city	5	0.000217	0.000136	0.000062	0.000021	0.000005	0.35
	10	0.000148	0.000123	0.000091	0.000060	0.000035	
	20	0.000093	0.000087	0.000078	0.000067	0.000055	
	25	0.000080	0.000076	0.000070	0.000063	0.000054	

Table 3.9: Concentration of NO_2 from the transportation of excavated and backfilled materials, demolished materials during construction of work items

Work item	L(m)= W (m)	NO2 Concentration (mg/m3)					QCVN 05:2013/BTNMT (Average 1h)(mg/m^3)
		H=1	H=2	H=3	H=4	H=5	
Infrastructure on Nguyen Luong	5	0.059656	0.059318	0.059010	0.058837	0.058771	0.20
	10	0.059368	0.059266	0.059133	0.059002	0.058897	

Work item	L(m)= W (m)	NO2 Concentration (mg/m3)					QCVN 05:2013/BTNMT (Average 1h)(mg/m^3)
		H=1	H=2	H=3	H=4	H=5	
Bang and Thanh Binh roads	20	0.059140	0.059115	0.059077	0.059030	0.058979	
	25	0.059084	0.059069	0.059044	0.059013	0.058977	
Rehabilitation of drainage system in the north of the railway	5	0.060789	0.060028	0.059335	0.058945	0.058797	0.20
	10	0.060140	0.059911	0.059611	0.059316	0.059080	
	20	0.059628	0.059572	0.059486	0.059380	0.059266	
	25	0.059502	0.059467	0.059411	0.059341	0.059262	
T1 canal embankment and construction of new Lo Cuong pumping station	5	0.059294	0.059091	0.058906	0.058802	0.058763	0.20
	10	0.059121	0.059060	0.058980	0.058901	0.058838	
	20	0.058984	0.058969	0.058946	0.058918	0.058888	
	25	0.058951	0.058941	0.058926	0.058908	0.058886	
Embankment on two banks of Bach Dang river	5	0.000634	0.000398	0.000182	0.000061	0.000015	0.20
	10	0.000432	0.000361	0.000268	0.000176	0.000103	
	20	0.000273	0.000256	0.000229	0.000196	0.000160	
	25	0.000234	0.000223	0.000206	0.000184	0.000159	
Construction of the wastewater collection and treatment system in the West of the city	5	0.000951	0.000596	0.000273	0.000091	0.000022	0.20
	10	0.000648	0.000542	0.000402	0.000264	0.000154	
	20	0.000410	0.000384	0.000343	0.000294	0.000241	
	25	0.000351	0.000334	0.000309	0.000276	0.000239	

Table 3.10: Concentration of CO from transportation of excavated and backfilled materials, demolished materials during construction of work items

Work item	L(m)=W (m)	CO concentration (mg/m3)					QCVN 05:2013/BTNMT (Average 1h) (mg/m^3)
		H=1	H=2	H=3	H=4	H=5	
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	5	3.8881537	3.8881523	3.8881511	3.8881504	3.8881501	30
	10	3.8881525	3.8881521	3.8881516	3.8881510	3.8881506	
	20	3.8881516	3.8881515	3.8881513	3.8881511	3.8881509	
	25	3.8881514	3.8881513	3.8881512	3.8881511	3.8881509	
Rehabilitation of drainage system in the north of the railway	5	3.8881583	3.8881552	3.8881524	3.8881508	3.8881502	30
	10	3.8881556	3.8881547	3.8881535	3.8881523	3.8881513	
	20	3.8881536	3.8881533	3.8881530	3.8881526	3.8881521	
	25	3.8881531	3.8881529	3.8881527	3.8881524	3.8881521	
T1 canal embankment and construction of new Lo	5	3.8881522	3.8881514	3.8881506	3.8881502	3.8881501	30
	10	3.8881515	3.8881513	3.8881509	3.8881506	3.8881504	
	20	3.8881510	3.8881509	3.8881508	3.8881507	3.8881506	

Work item	L(m)=W(m)	CO concentration (mg/m3)					QCVN 05:2013/BTNMT (Average 1h) (mg/m^3)
		H=1	H=2	H=3	H=4	H=5	
Cuong pumping station	25	3.8881508	3.8881508	3.8881507	3.8881506	3.8881506	
Embankment on two banks of Bach Dang river	5	0.0000026	0.0000016	0.0000007	0.0000002	0.0000001	30
	10	0.0000018	0.0000015	0.0000011	0.0000007	0.0000004	
	20	0.0000011	0.0000010	0.0000009	0.0000008	0.0000007	
	25	0.0000010	0.0000009	0.0000008	0.0000007	0.0000006	
Construction of the wastewater collection and treatment system in the West of the city	5	0.0000039	0.0000024	0.0000011	0.0000004	0.0000001	30
	10	0.0000026	0.0000022	0.0000016	0.0000011	0.0000006	
	20	0.0000017	0.0000016	0.0000014	0.0000012	0.0000010	
	25	0.0000014	0.0000014	0.0000013	0.0000011	0.0000010	

Comment:

Concentration of SO_2, NO_2, CO_2 that generate from process of transportation of excavated and backfilling work taking into account the baseline environment is within acceptable limit of QCVN 05:2013/BTNMT - National Technical Regulation on ambient air quality. This result shows that the impact of dust and gas emission from the transport vehicles is insignificant and can be assessed at LOW level. However, it should be noted that the concentration of CO, NO_2 and SO_2 can increase due to the increased mobilization of machinery and vehicles on the construction site. Therefore, it is required to have a plan for mobilization of the machinery and equipment.

b. Bad Odor

The dredging work of Bach Dang river, T1 canal, and sewer system in the North of the railway generates about 4,640 m^3, 6,400 m^3 and 67,531 m^3 of dredged material, respectively. The dredged materials is temporarily kept at the project area within 24-48 h before being transported by trucks to Sapharie Hai Duong domestic waste treatment plant. The analysis results of sediment samples taken at Bach Dang river, T1 canal, Nghe lake and the sewer system in the North of the railway show that, the concentration of heavy metals in the sample is lower than the allowable limit in the QCVN 07:2009/BTNMT. However, the dredged materials contains high content of organic matters and is stagnant in water for a long time. The decomposition of these organic matters will generate bad odor and hazardous gases such as CH4, H_2S… so the dredging of these materials will generate the bad odor affecting negatively people living in surrounding area. People and workers will be temporarily affected by the bad odor in distances of 50-100 m from the dredging work. In addition, the transportation of the dredged material will also pose the risk of bad order and leakage of the materials during the transportation. However, the dredged materials volume is medium and the storage and transportation are within a short time so the impact of bad odor to project community is temporary and in a short time. During the construction phase, it is required to pay special attention to the sites near Han Pagoda (the work item of rehabilitation of the drainage system in the North of the railway); Lo Cuong temple (T1 canal embankment) and the residential area in Tu Minh, Ngoc Chau, Pham Ngu Lao and Tran

Hung Dao ward to prevent any impacts on people's life and religious activities in these areas.

(2) Impacts on Noise

In the construction phase, the noise is mainly generated by operation of transport means, bulldozer, excavator, air compressor, etc. In general, due to the scope and nature of the work, the generated noise level is around 77-106 dBA (Source: Mackernize 1985). Cumulative noise from the construction is measured by the formula:

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

Where: L_{Σ}: total noise
li : noise level i
n : total noise source

When spreading in the air, the noise level can be reduced by distance, which can be calculated by following formula:

$$\Delta L = 20.\lg \left(\frac{r_2}{r_1} \right)^{1+a} \text{ (dBA)}$$

Where: ΔL – Noise level balance;
r1 – Distance to measure the typical noise level of the source, general at 1m from the source;
r2 – Calculated distance for the noise level reduction from the source, (m);
a – Coefficient, taking into account the noise absorption of terrain (for grass planting area, a = 0.1).

Based on the quantity of machinery and equipment mobilized for the construction, the resonant noise can be calculated by machinery's distance as follows:

Table 3.11: Noise level by distance generated from construction machinery and equipment

Work item	Machinery/Equipment	Distance to the noise source (m)				
		15	30	60	90	120
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	Total noise	73	66	60	56	53
	Bulldozer	70	64	57	53	50
	Excavator	67	60	53	50	47
	Truck	67	60	54	50	47
	Generator	73	66	60	56	53
Rehabilitation of drainage system in the north of the railway	Total noise	74	67	60	56	54
	Bulldozer	70	64	57	53	50
	Excavator	64	57	50	47	44
	Truck	70	63	57	53	50
	Generator	51	45	38	34	32
T1 canal embankment	Total noise	72	65	59	55	52
	Bulldozer	70	64	57	53	50

Work item	Machinery/Equipment	Distance to the noise source (m)				
		15	30	60	90	120
and construction of new Lo Cuong pumping station	Excavator	64	57	50	47	44
	Truck	65	59	52	48	45
	Generator	54	48	41	37	35
Embankment on two banks of Bach Dang river	Total noise	73	66	60	56	53
	Bulldozer	70	64	57	53	50
	Excavator	64	57	50	47	44
	Truck	68	62	55	51	48
	Generator	51	45	38	34	32
Construction of the wastewater collection and treatment system in the West of the city	Total noise	73	66	60	56	53
	Bulldozer	70	64	57	53	50
	Excavator	64	57	50	47	44
	Truck	68	62	55	51	48
	Generator	54	48	41	37	35
QCVN 26:2010/BTNMT (From 6h-21h) – General area		70				
QCVN 26:2010/BTNMT (From 21h-6h) – General area		55				

Comment: The results show that, the noise generated from the transport means and machinery within the distance greater than 15 m (day time) and greater than 90 m (night time) is within allowable limit in the standard QCVN 26:2010/BTNMT –National Technical Regulation on the Noise (70 dBA for general area from 6h – 21h, 55 dBA for the general area from 21h – 6h). Specifically:

Day time:

- Infrastructure on Nguyen Luong Bang and Thanh Binh roads: From construction point to 15m away, calculated noise level is 73 dBA (3 dBA more than acceptable limit).

- Rehabilitation of the drainage system in the north of the railway: From construction point to 15m away, calculated noise level is 74 dBA (5 dBA more than acceptable limit)

- T1 canal embankment and construction of the new Lo Cuong pumping station: From construction point to 15m away, calculated noise level is 72 dBA (5 dBA more than acceptable limit).

- Embankment on two banks of Bach Dang river: From construction point to 15m away, calculated noise level is 73 dBA (3 dBA more than acceptable limit)

- Construction of the wastewater collection and treatment system in the West of the city: From construction point to 15m away, calculated noise level is 73 dBA (3 dBA more than acceptable limit)

Night time:

- Infrastructure on Nguyen Luong Bang and Thanh Binh roads: From construction point to 15m away, calculated noise level is 73 dBA (18 dBA more than acceptable limit).

- Rehabilitation of the drainage system in the north of the railway: From construction point to 15m away, calculated noise level is 74 dBA (19 dBA more than acceptable limit)

- T1 canal embankment and construction of the new Lo Cuong pumping station: From construction point to 15m away, calculated noise level is 72 dBA (17 dBA more than acceptable limit)

- Embankment on two banks of Bach Dang river: From construction point to 15m away, calculated noise level is 73 dBA (18 dBA more than acceptable limit)

- Construction of the wastewater collection and treatment system in the West of the city: From construction point to 15m away, calculated noise level is 73 dBA (18 dBA more than acceptable limit).

Thus, the noise level generated during the construction phase has impact on small scale at day time and larger scale at night time. However, the said noise levels are calculated for conditions in which all means are operating the same point of time. Meanwhile, the construction items are split into many packages. As construction machines and equipment will be mobilized for each separate package and the operation of these machines and equipment will not exceed 8 hours a day, generated noise will not be continuous and will not last long. The impact is therefore assessed to be moderate. Noise impact from construction phase at the area as follows:

Table 3.12: Subjects and scope of impacts by noises of construction vehicles/machineries

No.	Work items	Affected subject	Distance to the construction area	Noise impact	
				Day time	Night time
1	Infrastructure on Nguyen Luong Bang and Thanh Binh roads	Hai Duong Medical College	50 m		x
		Hai Duong Medi-Tech University Hospital	Bordering the construction site	x	x
		Hai Duong Medi-Tech University Hospital	Bordering the construction site	x	x
		Residents living along the route and traveling on the route	< 15 m	x	
		Residents living in bordering area	15m - 90 m		x
2	Rehabilitation of the drainage system in the north of the railway	Han Pagoda (Cuc Lac pagoda)	Bordering the construction site	x	x
		Cemetary	Bordering the construction site	x	x
		Residents living near the construction site and traveling on the route	< 15 m	x	

No.	Work items	Affected subject	Distance to the construction area	Noise impact	
				Day time	Night time
		Residents living in bordering area	15m - 90 m		x
3	T1 canal embankment and construction of the new Lo Cuong pumping station	Lo Cuong temple	Bordering the construction site	x	x
		Residents living near the construction site and traveling on the route	< 15 m	x	x
		Residents in neighboring area	15m - 90 m		x
4	Residents living near the construction site and traveling on the route	Residents living near the construction site and traveling on the route	< 15 m	x	
		Residents living near the construction site	15m - 90 m		x
5	Construction of the wastewater collection and treatment system in the West of the city	Residents living near the construction site and traveling on the route	< 15 m	x	
		Residents living near the construction site	15m - 90 m		x

(3) Impacts due to Vibration

The completion of technical infrastructure on Nguyen Luong Bang and Thanh Binh roads, lining embankment of T1 canal, Bach Dang river and Nghe lake applies technology of pile driving sheets. Vibration impacts of the concrete pile jacking work are within 05 m for these work items. Among these work items, the lining of embankment and construction of operation roads along the Nghe lake will cause vibration affecting the residential area in the south of the lake and the Han pagoda.

The Han pagoda has its back wall as the border of Nghe lake and the back structures of the pagoda is 1-2m away from this wall, and thus the structures can be affected by vibration generated during the lining of the embankment.

According to the feasibility study report, in order to avoid impact on Han pagoda and the cemetery as well as on the residential area in the south of the lake, the project will occupy natural land area around the lake. Therefore, the land in the residential area in the south of the lake, the cemetery and Han pagoda will not be affected. Vibration impact during piling work of the project on this area is assessed to be moderate Additionally, rehabilitation of Nghe lake will help form a beautiful landscape for the pagoda, attract more visitors, increase land value, create clean living environment and relaxation area for community in general and for households living in the south of Nghe lake in particular.

Figure 3.1: Emulation of Han pagoda location at the construction area of Nghe lake embankment

Lo Cuong temple is about 35km from the construction site of T1 canal embankment and about 10m from the pumping station. These are safe distances so the temple will not be affected during the construction.

Embankment of Bach Dang river (from Tam Giang bridge to the dock): The land area on the river's two banks will be cleared prior to construction so the vibration impact will be minor.

Figure 3.2: Emulation of T1 canal, Lo Cuong pumping station and Bach Dang river embankment at sensitive locations not being affected by construction's vibration

Construction of the wastewater collection and treatment plant at the west of the city: The wastewater treatment plant will be constructed on a vacant land which is not close to sensitive receptors, therefore, there will be no vibration impacts on residents and structures in this area during the construction.

(4) Impacts on water quality

The sources of impacts on water environment include: (i) rainwater runoff in the project area; (ii) personal activities of the workers, (iii) construction wastewater; (iv) dredging work and sludge leakage and (v) Oil-containing wastewater

Pollution by rainwater/stormwater runoff

The rainwater can be contaminated because of being exposed to pollution sources like wastewater, polluted gas, polluted soil/sludge, etc. During the construction period, the surface runoff on the construction site can sweep away with sand, soil and wastes and construction debris, etc leading to the risks of:

- Affecting the water source, causing localized inundation because the surface runoff can bring suspended materials and waste to the canals and sewers, blocking the drainage capacity.

- Polluting the surface water around the project area because the surface runoff can bring domestic waste and construction waste to the water body.

- Affecting environmental sanitation and landscape because the surface runoff can bring wastes at the construction site to the surface water sources

The total rainwater runoff through construction sites under the Project can be calculated by following formula:

$$Q = \varphi \times q \times S \quad [7]$$

Where:

S : Total catchment area (m^2).

φ :

φ : Flow factor of cover surface (if cover area is mostly soil, φ = 0.2; mostly crushed-stones, without binding material - φ = 0.4; mostly asphaltic, cement concrete - φ = 0.6).

q : Rainfall intensity (l/s.ha), q = 166.7 x i

166.7 : is conversion factor, from water layer-wise rainfall intensity to volume-wise rainfall intensity

q : Rain intensity, q = 166.7 x i, with i being the highest water layer of the area in the month with highest rainfall (Hoang Hue – 1996). According to the area's hydrological data, the average rainfall in the rainy season is 290 mm/month (Chapter 2), with the assumption with 25 rainy days and 3 rainy hours/day, so i = 0.064 mm/minute → q = 10.743 (l/s.ha).

Table 3.13: Total volume of rainwater runoff in each sub-projects during the construction period

Work item	Rainwater drainage area (m^2)	Flow factor	Rainwater flow (l/s)
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	62,400	0.6	40.22
Rehabilitation of the rainwater drainage in the north of the railway	102,400	0.6	66.00
T1 canal embankment and construction of the new Lo Cuong pumping station	12,840	0.2	2.76
Embankment on two banks of Bach Dang river	14,000	0.2	3.01
Construction of the wastewater collection and treatment system in the West of the city	142,200	0.6	91.66

For concentration of pollutants in rainwater runoff, according to measurements made in 2009 by the Ho Chi Minh City Institute of Hygiene and Epidemiology, the concentration of pollutants in rainwater in urban areas with no contamination sources and with construction works is as follows (Table 3.14):

Table 3.14: Concentration of pollutants in rainwater runoff

Pollutant	Rainwater in urban areas	Storm water in urban areas with construction works	QCVN 40:2011/BTNMT (Column B)	Discharge load (kg/day)
1. COD (mg/l)	10 – 20	30 – 50	150	0.024 – 9
2. T-N (mg/l)	0.5 – 1.5	1– 1.5	40	0.01– 2.7
3. T-P (mg/l)	0.004 – 0.03	0.02 – 0.05	6	0 – 0.009
4. SS (mg/l)	10 - 20	80 – 120	100	2.4 – 21.6
5. Mineral oil & grease (mg/l)	<0.01	3– 5	10	0 – 0.9

Source: HCM City Institute of Hygiene and Epidemiology, 2009

Thus, in rainwater runoff flowing through the construction area, the content of suspended solids often exceed the permissible limits set out in national industrial wastewater standards (QCVN 40:2011/BTNMT)- Column B, while the content of mineral grease and oil, if not properly isolated, is likely to exceed the acceptable discharge limit. However, construction area under the project is wide and the amount of surface runoff through the construction sites is small. The surface runoff will drain to river and canal in the project area such as T1 canal, Bach Dang river and Sat river with the low surface runoff amount (Table 3.16) and proper management of the generated waste sources (construction contractors thoroughly collect the scattered materials and waste grease and oil during the construction phase, then the surface runoff will not take along any pollutants to the surrounding water bodies), there will not be any considerable impacts to the surrounding surface water sources.

Pollution by Workers' Domestic wastewater

About 230 workers will be mobilized for construction under the project, of which there will be about 40 – 50 workers for each construction site. Applying the QCXDVN 01:2008/BXD, the rate of domestic water consumption by the worker is 100 liters/person/day, including water for bathing, washing, cooking and personal hygienic issues. The generated wastewater is estimated to be 100% of daily water use amount. Thus, the domestic wastewater will be around 4.0 to 5.0 m3/day/work. Composition of the wastewater includes suspended solids, oil, grease and high content of organic matters, sediment, and dissolved organic matters (such as BOD5, COD), nutrients (Nitrogen, Phosphate) and micro-organism. Based on the World Health Organization's regulation on pollutant emission factors for the developing countries (following table), concentration of the pollutants in the domestic wastewater before being treated by septic tank is estimated as follows:

Table 3.15: Concentration of pollutants in domestic wastewater

(before treatment)

Pollutant	Pollution factor	Pollution factor (mg/l)

	(g/person/day)	Before treatment	QCVN 14:2008 (Column B)
BOD_5	45 – 54	1000 - 1200	50
COD	72 – 102	1600 – 2666	-
Total suspended solids	70 – 145	1555 – 3222	100
Oil and grease	10 – 30	222 - 666	20
Total nitrogen	6 – 12	133 - 266	50
N-NH4	2.4 – 4.8	53 - 107	10
Phosphate	0.8 – 4.0	17.8 – 88.9	10
Total Coliforms	106 – 109	22x106 – 22x109	5000(MNP/100ml)

(Source: WHO, 1993)

The above table shows that, untreated domestic wastewater contain much higher concentration of pollutants than the allowable limit in the regulation QCVN 14: 2008/BTNMT (column B). Without a daily collection and treatment system for wastewater, there will be an amount of pollutants discharged to the environment. This will be a significant pollutant source directly affecting living environment of workers and people living in the project area, causing dieases and directly affecting groundwater and surface water. Therefore, construction contractors are required to have measures for wastewater collection and treatment.

Pollution by construction Wastewater

The construction wastewater is generated from the activities of washing material, equipment and machineries. This type of wastewater has high content of suspended solids and organic matters. Its composition is presented in following table:

Table 3.16: Content of pollutants in the construction wastewater

No.	Parameter	Unit	Construction wastewater	QCVN 40:2011/BTNMT
1	pH	-	6.99	5.5 – 9
2	SS	mg/l	663.0	100
3	COD	mg/l	640.9	100
4	BOD5	mg/l	429.26	50
5	NH4+	mg/l	9.6	10
6	Total N	mg/l	49.27	30
7	Total P	mg/l	4.25	6
8	Fe	mg/l	0.72	5
9	Zn	mg/l	0.004	3
10	Pb	mg/l	0.055	0.5
11	As	mg/l	0.305	100
12	Grease and oil	mg/l	0.02	5
13	Coliform	MPN/100ml	53 x 104	5,000

Source: Center for Environmental Engineering of Towns and Industrial Areas (CEETIA) – National University of Civil Engineering

The results in the Table 3.16 show that, some parameters in the construction wastewater under the project are within allowable limits in the QCVN 40:2011/BTNMT. Only the total suspended solid, COD, BOD_5 and Coliform is 6.6 times, 8 times, 8.6 times and 106 times higher than the allowable limits, respectively. This type of wastewater does not exist in great volume, however,

if there is no proper management but directly discharging the wastewater to the environment, it will pollute surface water and groundwater and affect the workers' health.

Reduction of water quality due to dredging work and sludge leakage

Water quality can be degraded due to the dredging work of Bach Dang river and T1 canal. The expected sediment of Bach Dang river and T1 cannal is about 4,640 m^3 and 6,400 m^3, respectively. The dredging work will cause water turbidity, reduce water quality at the dredged area. The dredged sediments along Bach Dang river and T1 canal will be piled up along the canal/river to reduce volume and dehydrate before being transported to disposal site. At this stage, the sediment is in liquid state so its storage can generate fluid leakage. Other similar projects show that the content of suspended solids can be 800-1400 mg/l and F. Colifom can be from 90-200 MPN/100ml in the leaked sludge. Thus, there should be proper management for this leakage.

In general, the impact under the project construction on water quality in the project areas is medium and lasts in a short time. The construction contractors need to abide mitigation measures to minimize the impacts on water environment.

Oil-containing wastewater

Construction equipment/machine maintenance water: Construction equipment/machinery maintenance activities take place at the machinery gathering locations in construction areas, that generate about 11m^3 of oil-containing WW/day (Table 3.17). Oil contents are within the acceptable limit of QCVN 40/2011/BTNMT, Column B upon discharging to canals that is not for category of water supply like Bach Dang river and Sat river in the project area (Cmax oil in Bach Dang and Sat rivers = C x Kq x Kf = 10 x 0.9 x 0.9 = 8.1 mg/l).

Table 3.17: Volume and concentration of pollutants in wastewater generated by machinery maintenance

Type of wastewater	Volume (m^3/ day)	Concentration of pollutants		
		COD (mg/l)	Oil (mg/l)	SS (mg/l)
By maintenance	2	20 ÷ 30	–	50 ÷ 80
By cleaning	5	50 ÷ 80	1,0 ÷ 2,0	150 ÷ 200
By cooling	4	10 ÷ 20	0,5 ÷ 1,0	10 ÷ 50
Total	11	30 ÷ 49	0,6 ÷ 1,3	81 ÷ 124
QCVN 40:2011/BTNMT, Column A		C=50	C=5	C=50
QCVN 40:2011/BTNMT, Column B		C=100	C=10	C=100

Remark: Column A is with value C of pollutants of industrial WW upon discharge in to sources that will be used for domestic water supply; Column B is with value C of pollutants in industrial WW upon discharge into source that will not be used for domestic water supply.

Thus, impact level was assessed at MEDIUM and only occurring in construction phase and can be mitigated.

(5) Impacts from Solid Waste

There are three main kinds of solid waste generated during the construction of Component 1: (1) Construction solid waste (debris); (2) Domestic solid waste; (3) Hazardous solid waste. The generated volume of solid waste is assessed as follows:

Construction Solid Waste

Construction solid waste is generated mainly from the demolition of the existing structures, plants ,excavated soil, dredged material, packages, debris, steel pieces on the construction site. The volume of construction solid waste is calculated and represented in following table:

Table 3.18: Volume of construction solid waste during the construction

Work items	Volume of excavation	Volume of Demotion	Volume of backfilling	Volume of dredged material	Total
	m^3	m^3	m^3	m^3	m^3
Infrastructure on Nguyen Luong Bang and Thanh Binh roads	3,000	2563.56	46,400	-	59,400
Rehabilitation of the rainwater drainage in the north of the railway	76,884	0	57,506	67,531	201,921
T1 canal embankment and construction of the new Lo Cuong pumping station	24,000	0	19,200	6,400	49,600
Embankment on two banks of Bach Dang river	10,700	0	46,400	4,640	61,740
Construction of the wastewater collection and treatment system in the West of the city	520,822	396.73	60,313	-	581,135
Total	635,406	2960.30	229,819	78,571	-

The construction solid waste is mostly general solid waste so it will not cause serious environmental pollution. However, the storage and transportation of the waste can affect community in the project area such as:

- Generation of dust during the storage and transportation;

- Influence on residents and transport system when the waste spills or falls at the storage area near residential areas and the existing roads;

- Increase in the content of TSS when the waste spills or falls into water sources. The project area is near Bach Dang river and Sat river…so the waste can pollute surface water if there is no proper management and collection method.

Domestic Solid Waste

At the peak contruction time, about 40 – 50 workers will be mobilized at each construction site. Applying the QCXDVN 01: 2008/BXD, each worker will generate about 0.9 kg domestic waste per day. Thus, total daily domestic waste is about 36-45 kg/day at each construction site. This type of waste mainly includes nilon bag, package, residual food….of which the composition is 60 – 70% of organic matters and 30 – 40% of other matters, posing high risk of bacteria and disease source. Without proper management, this type of waste will affect surface water, cause

bad odor at the construction site when it decays or is swept away by the surface runoff. Therefore, the impact of the solid waste is considered medium, temporary and manageable.

Hazardous Solid Waste

Hazardous solid waste generated under the project includes waste oil, oily cloth, oil rags. According to the hazardous waste management rule, the waste oil is considered hazardous waste. Generation of waste oil and grease from the maintenance and repair of the transportation vehicles and machinery under the project is unavoidable. It depends mainly on:

- Number of transportation vehicles and construction machinery on the construction site

- Amount of the oil and grease generated from the transportation vehicles and construction machinery

- Frequencies of oil change and maintenance of machinery and equipment

On average, the amount of waste oil and grease generated from the transportation vehicles and construction machinery is 7 liter/change. The frequency of oil change and maintenance of machinery and equipment is maximum once in every three months. Thus the generated waste oil and grease on the construction site for each work item as follows:

Table 3.19: Generated hazardous waste

No.	Work item	Maximum number of vehicles and machinery (number)	Volume of waste oil/grease per month (kg)
1	Infrastructure on Nguyen Luong Bang and Thanh Binh roads	40	93
2	Rehabilitation of the rainwater drainage in the north of the railway	29	68
3	T1 canal embankment and construction of the new Lo Cuong pumping station	38	89
4	Embankment on two banks of Bach Dang river	34	79
5	Construction of the wastewater collection and treatment system in the West of the city	40	93

Therefore, there will be about 68 – 93 kg of waste oil and grease generated on the construction site per month. This amount will be stored in 150-200*l* tanks arranged at the maintenance and repairing place on the construction site, and then it will be sold to competent authority for recycling. In addition, there will be about 50kg of oily cloth and oil rags discarded per month. The waste oil can penetrate into the environment due to overspilling or being swept away by the surface runoff. The oil generated from the overspilling or washing depends on the storage location and the project's management capacity. The project area is near watersheds so the waste oil can penetrate into the surface water and pollute the water source. Thus, it is required to have proper management for the discard and storage of this amount of waste oil and grease to protect the surrounding surface water quality. The impact is assessed to be medium.

(6) Traffic Disturbance and Traffic Safety Risks

The installation of sewer system on Nguyen Luong Bang and Thanh Binh roads will require excavation of tunnel and laying of the wastewater collection culvert along the existing roads, which will affect transport, increase the risk of traffic accidents and obstruct people's access to

their houses along the route. The construction will be made in sections and at one side road while the other side of the road will be reserved for the transport purpose. Then the construction, excavation and laying of the sewer will partially occupy the existing road surface, obstruct the transport and pose the risk of traffic accidents. The excavation and backfill work can cause falling of soil and sediment on the road, leading to traffic safety risks in rainy condition.

The construction of pumping stations and wastewater treatment plant will also cause transport obstruct but on small scale because the wastewater treatment plant will be located in Tu Minh ward, the disposal site is agricultural land and the transportation route runs through thinly populated areas.

Table 3.20: Sensitive works under the impacts on transport and traffic safety risks

No	Sensitive works	Description
Road and residential areas along the road		
1	Nguyen Luong Bang road	Laying of D1000-1500 culvert
2	Thanh Binh road	Laying of D1500 culvert
Sensitive works		
1	Hai Duong Medical College	Laying of D1000-1500 culvert on Nguyen Luong Bang road
2	Hai Duong Medi-Tech university	Laying of D1000-1500 culvert on Nguyen Luong Bang road
3	Tuberculosis and Lung Disease Hospital	Laying of D1500 culvert on Thanh Binh road
3	Kim Chi pagoda	Laying of D1500 culvert on Thanh Binh road
4	Medical station in Tu Minh ward	The route for transportation of construction waste
5	Thanh Dong university	The route for transportation of construction waste

(7) Impact on Existing Infrastructure

During construction of wastewater collection sewer, many roads will be excavated or affected by the storage and transportation of construction materials and wastes. Thus, the project construction can cause adverse impact on urban infrastructure including water drainage and supply, electricity, telecommunication systems, damage and interrupt public services. However, this impact is considered small because the layout and construction methods have been considered prior to construction process to minimize further adverse impacts. After laying the sewer system, road surface, sidewalk or urban technical infrastructure will be restored by using the cost included in the package value.

(8) Localized flooding

At present, the area for construction of the wastewater collection system in the west of the city, Thanh Binh and Nguyen Luong Bang roads and the northern area of the railway…usually get localized inundation. In this zone, there are both new urban areas and old residential areas of which the new urban area's elevation is higher than the old residential areas. The road side drainage system does not have sufficient capacity. Thus, the area is regularly flooded in rains. Moreover, in recent years, weather condition has been abnormal leading to severe flood and

inundation in the area in annually rainy season. Particularly in the rain on 28th August 2016, the measured rainfall was up to 158.8mm flooding Nguyen Luong Bang road up to 60cm in 1-2 days.

Therefore, it is required to prepare drainage solution during the construction process. Rain can flood the site, affect construction progress and it can also drag construction wastes and solid waste into the existing sewer system, blocking the sewer, reducing drainage capacity and causing long-lasting inundation. Construction contractor should proactively arrange flood protection solution at the construction site. In addition, attention should also be paid to the risk of inundation caused by shallow aquafier (at depth of 0.2-1.5m) when excavating foundation pit and tunnel, particularly at the construction area of the WWTP and the pumping station because this can affect construction progress. The impact level is considered low.

(9) Impact on city landscape

Installation of drainage sytems for rainwater and wastewater or construction of the ditch system, setting up of wall fences for the construction sites. These operations would temporarily cause changes in the local landscapes. Besides, construction materials would also be transported and gathered at construction sites. Without proper management, materials can be mixed up, especially in narrow construction sites, affecting the area landscape.

The rehabilitation / construction of Nghe lake, T1 and Bach Dang canal would cause small impacts on the general landscape of the city. Conversely, this is an opportunity to create a general harmonious and beautiful landscape in the city. The level of impact on urban beauty and landscape in these areas is assessed to be insignificant level.

(10). Impacts from risks and incidents

Labor accidents

In general, traffic accidents may happen at any time during the construction of the subproject for which the causes include:

- Environmental pollution may cause fatigue, dizziness or fainting for workers during their work.
- Loading/unloading, construction and transport of materials without attentive care can cause labor accidents, traffic accidents, etc.
- Accidents due to negligence in work, lack of labor protection, or due to lack of awareness of strictly complying with the labor safety rules for construction workers.

Given the nature and scale of the construction activities under the component, this risk is assessed as moderate. The Subproject Owner will pay attention to the application of safety measures for workers.

Fire, explosion and leakage of fuel

Fire and explosion may occur in the case of transport and storage of fuel, or lack of safety of the temporary power supply system, causing the loss of life and damage to property during the construction process. The specific causes are identified as follows:

- The temporary fuel and material warehouse (gas, DO oil, FO oil, welding gas, etc.) are the source of fire and explosion. The occurrence of such incidents can cause serious damage to people, society, economy and the environment.

- Temporary power supply system for machines and equipment during construction can cause problems of shortcircuit, fire, explosion, electric shock, etc leading to economic and labor accidents for workers.

- The subproject owner will implement the fire prevention and strictly comply with measures to prevent leakage, fire or explosion. The fire prevention shall be done regularly to minimize the possibility of incidents and the levels of impact.

Health and Safety Risk to the Community

Risks of accidents caused to the residents by travelling/transportation using vehicles during construction must also be taken into account of by the construction contractors. Transportation activities using trucks need to have support of traffic regulator upon passing through residential areas. Since there are many households leaving along the roads within immediate proximity to the construction areas, the likelihood of the safety risk to the community is high. This impact is assessed as moderate.

Various and operations would generate domestic wastewater and wastes giving rise to large populations of flies and mosquitoes, and possibly forming epidemic nests of diarrhea, dengue fever, and malaria. Workers coming during the construction process, etc. will result in dirty pools and pits, polluting water sources and the air, giving rise to large populations of flies and mosquitoes, and possibly forming epidemic nests of diarrhea, dengue fever, and malaria. Such impacts could only be mitigated or minimized with good prevention, treatment and sanitation measures. Concentration of workers in the area may result in increased contraction of HIV/AIDS and other sexually transmitted diseases, especially through prostitution, posing risks to the local community. However, as the work is at a small scale, and construction would not last long, this impact is low and controllable.

(11)Improperly finished construction sites

Good construction practices should aim to avoid residual impacts at work sites. Abandoning stockpiles of construction materials (gravel, aggregate, sand...) can pose aesthetic impacts and safety concerns at affected sites.

Site-specific Impacts

- **Sub-component 1.1: Completion of technical infrastructure on Nguyen Luong Bang and Thanh Binh roads**

(i) Localized flooding

In recent years, due to the climate change and particularly in 2016, after the rain on 28th August 2016, the measured rainfall was up to 158.8mm flooding Nguyen Luong Bang road up to 60cm in 1-2 days. Installation of the reinforced concrete sewer system can temporarily affect the

natural drainage system on the road surface. The impact is assessed to be medium and mitigable by applying good construction method. Therefore, the completion of technical infrastructure on Nguyen Luong Bang and Thanh Binh roads should be paid special attention and should be done fast. Construction should not be conducted in rainly season to avoid localized inundation.

(ii) Transport hinderance and impacts on business activities

To ensure drainage capacity for the Nguyen Luong Bang and Thanh Binh roads, one new reinforced concrete sewer system will be constructed under the project, which will be adjacent to the existing system and under the roadbed. The construction will hinder transport on the two roads. In addition, there is dense population living along these two roads with various business activities from small shops to restaurants. So, construction contractors will need to separate the lanes for transport and construct step by step at one side. The construction will last in a short time, so the impact in this phase is temporary and short-term.

(iii) Impacts on Sensitive receptors

Impact on Hai Duong Medical College (70 m from Nguyen Luong Bang road):

The entrance to Hai Duong Medical College is on Nguyen Luong Bang road, distanced 50-70m from the road. The reinforced concrete sewer system will be installed on Nguyen Luong Bang road so the construction will not affect daily routine of teachers and students in the college. However, the construction can affect teachers and students by causing: (i) access hinderance to the college; (ii) traffic jam at the intersection between the road and the college; (iii) safety risk. However, the successive construction method will be applied and the construction lasts in a short time so the impact on the college is negligible.

Impacts on Hai Duong Tuberculosis and Lung Disease Hospital (adjoining Thanh Binh road) and Hai Duong Medi-Tech Universtiy Hospital (Adjoining Nguyen Luong Bang road)

Hai Duong Tuberculosis and Lung Disease Hospital and Hai Duong Medi-Tech Universtiy Hospital are located on Thanh Binh and Nguyen Luong Bang roads, respectively. However, the treatment and checking areas are 100m from the roads so the installation of the reinforced concrete sewer system on the roads will can cause impacts on patients, patient's relatives and hospital staffs such as: (i) access hinderance to the hospitals; (ii) traffic jam at the intersection between the road and the hospital; (iii) safety risk for people go in and out the hospitals. However, the successive construction method will be applied and the construction lasts in a short time so the impacts on the hospitals are negligible.

Table 3.21: Impacts on sensitive receptors on Thanh Binh and Nguyen Luong Bang roads

No.	Sensitive locations	Work item	Distance to the construction site (m)	Impact
1	Tuberculosis and Lung disease Hospital	Thanh Binh road	Adjoin Thanh Binh road	i) Access hinderance to the hospital; (ii) traffic jam at the intersection between the road with the hospital; (iii) safety risk for people

No.	Sensitive locations	Work item	Distance to the construction site (m)	Impact
				
2	Hai Duong Medical College 	Nguyen Luong Bang road	Entrance is located on Nguyen Luong Bang road	i) Access hinderance to the colege; (ii) traffic jam at the intersection between the road and the colege; (iii) safety risk for students and teachers. Note: School time: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 every weekday.
3	Hai Duong Medi-Tech University Hospital 	Nguyen Luong Bang road	Adjoin Nguyen Luong Bang road	i) Access hinderance to the hospital; (ii) traffic jam at the intersection between the road and the hospital; (iii) safety risk for people

- **Sub-component 1.2: Rehabilitation of the drainage system in the north of the railway: including rehabilitation of Nghe lake, the ditch system in the north of the NH5 to Nghe lake and Binh Lau pumping station**

(i) Localized flooding

The project area is located in the third catchment area of 990ha wide between NH5 and Thai Binh river. Water in this area will flow to Thai Binh river (forced by the pumping station). In this area, there are drainage pumping stations namely Dong Han, Binh Bien and Binh Han. Binh Han pumping station has poor capacity due to poor efficiency of the ditch and in the absence of compensating reservoir. The catchment area is low-lying with elevation from 1.6m to 2.9m, located within the NH5 which has average elevation of 3.3m and the railway which has average elevation of 2.7 m -3.1m. Therefore, the dredging work in this area can temporarily block the sluice gate on the route, reducing drainage capacity. However, this impact is considered low because the construction will last in a short time. Impacts can be mitigated by applying good construction methods such as management of construction material, excavated and backfilled materials. When the construction is completed, the overall drainage capacity will be improved, serving the drainage function for the whole area.

(ii) Impact on Aquatic Systems

The impacts on the terrestrial and aquatic ecosystem during the construction and embankment of Nghe regular lake will be insignificant as the area is not in the protected zones and native plants and benthic species are not common with no listed species. The level of impact to the aquatic ecosystem thus is considered to be low.

The dredging work in Nghe Lake is dry dredged. Dredged mud will be gathered along the lake banks. From experience of similar projects, mud leachate has a total SS content of about 800-1400 mg/l and F. Coliform content of 90-200 MPN/100ml. The direct discharge of the leachate to the water course would cause degraded water quality, and therefore needs to be well managed.

It should be noted that the canals currently receive unregulated, untreated domestic wastewater and are consequently relatively polluted, but this could be exacerbated during dredging by remobilization of sediments. In the long term, the water quality will be enhanced during operation and the impact is therefore assessed as small, temporary and reversible.

(iii) Impacts on Physical Cultural Resources (PCRs)

Han pagoda (Cuc Lac pagoda) and cemetary locates in the East of Nghe lake. The construction site is adjacent to the border of Nghe lake and 1-2m distanced from the pagoda's back yard and the cemetary Therefore, the dreding and lining embankment for Nghe Lake can generate impacts like: (i) Dust, noise, vibration during construction phase; (2) dust and air pollution; (iii) Increased traffic safety risks; (iv) conflict between worker and visitor to th pagoda and the cemetary.

Table 3.22: Impacts on the PCRs on Nghe lagular lake

No	Sensitive	Work item	Distance to construction site (m)	Impact
1	Han pagoda (Cuc Lac) 	Rehabilitation of the Nghe Lake	Adjacent to Nghe lake	- Noise, dust and vibration from construction activities - Reduce of number of visitors, - Risks of traffic accidents and safety, and - Conflicts between workers and visitors to the pagoda. - It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day
2		Rehabilitation of the Nghe Lake	Adjacent to Nghe lake	− Hindrance of access, - Reduce of number of visitors, - Conflicts between workers and visitors to the Cemetery

- **Sub-component 1.3: T1 canal embankment and construction of new Lo Cuong pumping station**

(i) Impacts on Inland Waterway

The Sat river is also one inland waterway transport route of the city for transportation of coal and construction material. Ships navigating on the river are mostly around 100 tons ships. However, Lo Cuong pumping station will be constructed on the river bank at small scale so its construction almost causes no impact on this waterway navigation. T1 canal is not a navigation route so the project impacts on waterway system is low.

(ii) Impact on Aquacultural Production

Lo Cuong pumping station adjoins to the Sat river along which there are fish cage farming for butterfish, Ctenopharyngodon idella, Cyprinus carpio and Tilapia. Therefore, during construction phase, it is required to prevent leachate of wastewater at the site which can affect household's farming output. Otherwise, construction contractor will have to compensate reasonably.

(iii) Impact on Agricultural Land and Fruit-tree Plantation

The area in the west of T1 canal is mainly field land and fruit-tree gardens. Therefore, the mobilization and gathering of machinery and equipment as well as the gathering of the construction material and dredged material during the dredging of the canal can affect household's field land and garden. Impacts during the construction phase is short-term and can be mitigated by applying good construction method. Any impacts on crops on land during the construction will be compensated by the construction contractor.

(iv) Risks on Soil Erosion, Embankment Subsidence, and House Damage during Embankment

During the dredging and lining the embankment of canals, there can be risks on soil erosion and landslide due to: (i) construction on weak soil; (ii) Gathering of heavy equipment and machinery on the canal banks; (iii) encountering of groundwater aquifer in dredging process; (iv) vibration during the piling work. Landslide and embankment subsidence can cause life and asset safety risks in the project area. Surveyed results show that, 1.3km of one bank of the T1 canal bank is Vu Manh Hung road which is a two-lane asphalt road, and about 0.28km of the canal bank's end section is 3m-wide concrete road. The other bank of the T1 canal is rice field and fruit-tree gardens. The lining of T1 canal embankment will require concrete piling which can affect house's structure within 5m distance. About 5m from the beginning section of T1 canal there is one small business establishment. Thus, impacts from the canal dredging and embankment will be at low level.

(v) Impacts on the PCRs and senstive receptors

Impacts on Lo Cuong temple (about 30m from Lo Cuong pumping station and T1 canal)

Lo Cuong temple is located on the bank of Sat river and about 30m from the tentative construction area of Lo Cuong pumping station. Thus, construction of the pumping station and T1 embankment lining will cause impacts like: (i) dust, noise, vibration during the construction phase; (2) dust and air pollution; (iii) increased traffic safety risks; (iv) conflicts between workers and visitors to the temple.

Impact on Thanh Dong university (about 300m from T1 canal)

Thanh Dong university is located about 300m from the construction site of T1 canal and on the transportation route of construction material and wastes from the construction site. Therefore, during the transportation, the university can be affected by (i) dust, noise and gas emission from the transportation trucks; (ii) impact on teachers and students' daily routine (iii) traffic safety risks. However, the transportation of material only lasts in a short time so the impact is assessed to be medium and mitigable.

Impact on the medical station in Tu Minh ward (about 150 m from T1 canal)

The medical station in Tu Minh ward is about 150 m from the construction site of T1 canal. However, it is located on the transportation routes of material and gas emission from the construction site, so it can be affected by: i) dust, noise and waste from the transportation trucks; (ii) impact on staffs and patients; (iii) traffic safety risks. However, the transportation of material only lasts in a short time so the impact is assessed to be medium and mitigable.

Table 3.23: Impacts on the PCRs during the construction of Lo Cuong pumping station and T1 canal

No.	PCR	Work item	Distance to the construction site (m)	Impact
1	Lo Cuong temple 	Lo Cuong pumping station, about 30m from T1 canal embankment	Adjoining the construction site of Lo Cuong pumping station; about 30m from T1 canal embankment site	- Hinder access to the temple - Reduce number of visitors - Traffic safety risks - Conflicts between workers and visitors It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day
2	Thanh Dong university 	T1 canal embankment; the transportation route for waste from the construction site	About 300m from the construction site of T1 canal embankment, and about 150m from the disposal site, located on the transportation route.	Dust, noise and gas emission generated from the transportation trucks Impact on teachers and students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday
3	Medical station in Tu Minh ward	T1 canal embankment; the transportation route for waste from the construction site	About 150 m from the construction site of T1 canal embankment, and about 350m from the disposal site, located on the transportation	Dust, noise and gas emission generated from the transportation trucks Impact on staffs and patients Traffic safety risk

No.	PCR	Work item	Distance to the construction site (m)	Impact
			route.	

- **Sub-component 1.4: Embankment on two banks of Bach Dang river**

(i) Impact on Ecosystem and Mollusca Output

Construction of the 2.8 km of Bach Dang river embankment will require dredging of 4,640 m^3 of soils and sediment. The construction will have impacts on the river water quality, aquatic and bentic communities, and impacts associated with transportation and disposal of the dredged soils and sediment.

River dredging may give rise to the amount of suspended solids swept away toward the river downstream. The rainfall runoff around the subproject area will be accompanied with pollutants including construction material, soil, sand, grease and oil flowing into the river, affecting the water quality of Bach Dang river.

The biome structure and variations of the related aquatic species show that the water environment in Bach Dang River has been affected by organic pollution. Some aquatic plant species in the river include water hiacynth, water cabbage, watermoss, water spinach, nipa palm, water ginger grass, etc. In this river section, there are no endemic or reare species listed in the Red Book which require protection, and there are no natural vegetation and no rare or typical fauna and flora.

The level of the impacts, therefore, is moderate. However, it could be completely controlled and mitigated if the contractor fully complies with regulations on traffic safety, regulations on transport routes and the proposed construction methods and implement all mitigation measures described in the ESMP.

At present, there are Mollusca species living in Bach Dang river, including shrimps, crabs and snail and are harvested by people in neighboring area. In particularly, households living on floating rafts (at the end section of Bach Dang river embankment – adjacent to the dock) are making daily living by fishing and havesting shrimp and snail. Daily income of each person is about 50,000VND-100,000VND/day. However, this is only the additional income source for people's agricultural production and fisheries at other location. The dredging work will be fast so the impact will be temporary in a short-term and will not affect local households' livelihood.

(ii) Landslide on Bach Dang river banks

As analysed for T1 canal, the dredging and lining embankment for the river bank can be pose the risks on soil erosion and landslide due to: (i) construction on weak soil – there is frequent landslide on Bach Dang rive banks; (ii) Gathering of heavy equipment and machinery on the

canal banks; (iii) encountering of groundwater aquifer in dredging process; (iv) vibration during the piling work. Landslide and embankment subsidence can cause life and asset safety risks in the project area. Sensitive receiptors include infrastructure, workers and local residents in the canal area, particularly in the densely populated area along Bach Dang river banks. These impacts are localized, in short-term and only happen in the construction phase, which can be mitigated and avoided with proper geological survey and thorough consideration during the detailed design process by applying good construction methods.

The embankment of Bach Dang river bank will require concrete piling work, which can affect house structure within 5m. Along the river banks, there are many houses located within this distance. However, these houses will be displaced for the construction of the management road of 2-4m wide and for the installation of the lighting system along the embankment. Therefore, there will be no impacts on houses during the construction phase if the site clearance is done prior to construction.

(iii) Impact on local bridge

There is one local bridge at a distance of about 200m from the end terminal of Bach Dang river, which connects Chuong Duong road to Cau Con road. This bridge is made of iron, about 10m wide and is only used for local motorbikes and bikes (no cars). The lining of Bach Dang river embankment will pose the risk of damaging the bridge so the access to local people's house will be affected. However, this risk is low and avoidable by applying suitable mitigation measures.

(iv) Disruption of business activities

As identified in the inventory of loss under the resettlement survey, there will be 15 affected households who have small business and trading activities such as convenience shops, tailor's, coffee shops, hairs and nails' spa. Besides being a safety risk, noise and dust from road construction activities and equipment might temporarily disrupt business activities. The contractor should take precaution for these issues to avoid accidents and dust affecting shops.

- **Sub-component 1.5: Construction of the wastewater collection system in the west of the city**

(i) Impact on Ecosystem and Fishery Output

The wastewater treatment plant in the west of the city also adjoins the Sat river where there are fish cages for farming of butterfish, Ctenopharyngodon idella, Cyprinus carpio and Tilapia. Therefore, during construction phase, it is required to prevent leakages of wastewater at the site which can affect household's farming output. Otherwise, construction contractor will have to compensate reasonably. The construction of the drainage system is mainly on urban land; the main pipeline will mainly be laid on the sidewalk for road shoulder so there will be no impact on the ecosystem.

(ii) Impact on Existing Infrastructure

During the construction and installation of wastewater drainage pipeline, the project will affect 127.14 km asphalt road and concrete road in the residential areas of 7 wards namely Cam Thuong, Binh Han, Nhi Chau, Thanh Binh, Tan Binh, Tu Minh and Viet Hoa. The project will also hinder people's movement and access to shops and works on the route. However, this impact is considered negligible because the layout and construction methods have been considered prior to construction process to minimize further adverse impacts. After laying the

sewer system, road surface, sidewalk or urban technical infrastructure will be restored by using the cost included in the package value.

(iii) Impact on Sensitive receptors

Construction site of the WWTP

Thanh Dong university is located about 150m from the construction site of the WWTP. Therefore, during the construction phase, the university can be affected by (i) dust, noise and gas emission from the transportation trucks; (ii) impact on teachers and students' daily routine (iii) traffic safety risks. Therefore, the construction contractors need to apply mitigation measures for controlling noise, dust and vibration. The impact in this case is assessed to be medium and can be manageable.

Table 3.24: Impacts on sensitive receptors on construction of the wastewater collection system in the west of the city

No	Sensitive location	Work item	Distance to the construction site (m)	Impact
1	Thanh Dong university 	Construction of the WWTP	150	Dust, noise and gas emission generated from the transportation trucks Impact on teachers and students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday

Construction of 24 booster pumping stations:

Construction of 24 booster pumping stations with capacity from Q=238 m^3/day to Q=12,000 m^3/day and the forced pipeline D300-D600 with length L=1.53 km can affect sensitive works such as school, market and pagoda/temple. However, the construction process will be fast and last in a short time. Therefore, impact on PCRs and sensitive works is at low level. Table below presents locations of sensitive works and possible impacts during the construction of the booster pumping stations.

Table 3.25: Impacts on PCRs and Sensitive receptors on construction of 24 Booster pumping station

No	Sensitive location	Work item	Distance to the construction site (m)	Impact
1	Nhi Chau kindergarten	Booster pumping station No. 1	50	Dust, noise and gas emission generated from the transportation trucks Impact on teachers and

No	Sensitive location	Work item	Distance to the construction site (m)	Impact
				students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday
2	Viet Hoa kindergarten 	Booster pumping station No. 5	10	Dust, noise and gas emission generated from the transportation trucks Impact on teachers and students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday
3	Tan Binh kindergarten 	Booster pumping station No. 16	1	Dust, noise and gas emission generated from the transportation trucks Impact on teachers and students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday
4	Tu Minhkindergarten 	Booster pumping station No. 21	20	Dust, noise and gas emission generated from the transportation trucks Impact on teachers and students's daily routine Traffic safety risk -Note: School time from: 7h-7h30; 11h-11h30; 13h-13h30; 16h30 - 17h30 on the weekday
5	Dong Nien temple 	Booster pumping station No. 5	35	- Hinder access to the temple - Reduce number of visitors - Traffic safety risks - Conflicts between workers and visitors It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day

No	Sensitive location	Work item	Distance to the construction site (m)	Impact
6	Co Hoai temple 	Booster pumping station No. 10	30	- Hinder access to the temple - Reduce number of visitors - Traffic safety risks - Conflicts between workers and visitors It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day
7	Cam Khuc Pagoda 	Booster pumping station No. 22	22	- Hinder access to the temple - Reduce number of visitors - Traffic safety risks - Conflicts between workers and visitors It is noted that on the first day and 15th day of every lunar month, number of visitors will be more than normal day
8	Local market 	Booster pumping station No. 24	15	Limiting to transport materials/wastes (for constructing the items of Bosster pumping satation when passing by Local Market at the peak hours (morning: 5-9h; noon: 11-12h; afternoon and evening: 16 - 19h), which does not create any obstacles to the travelling/business activities of the residents. Spray sufficient water to suppress dust during dry and windy days at least two times a day at road along the market area.

3.1.3.3. Impact during Operation Phase

- **Sub-component 1.1: Complete the drainage system on Nguyen Luong Bang and Thanh Binh road**

(i) Risk of local flooding due to the poor operation and maintenance

The operation and maintenance of newly installed drainage system on Nguyen Luong Bang and Thanh Binh road if not well maintained could potentially affect the drainage capacity, especially on rainy days, causing local flooding to some parts of these roads. However, the impact can be low if proper O&M practices are adopted.

- **Sub-component 1.2: To rehabilitate the rain water drainage system in the north of the railway**

(i) Water pollution and decreased lanscape due to direct waste disposal into Nghe regular lake

During the O&M, there might be some risks of pollution and flow stagnation due to disposal of waste from households living along Nghe regular lake if their behaviors are not change and there is lack of enforcement from local authority. The level of impact can be from low to moderate. The impact however can be mitigated if proper O&M practices adopted and enforcement enhanced. Besides, behavior changes can happen as local people can be proud of new green design of canals and lake and want to collaborate to maintain the canal' and lake's clean and beauty.

(ii) Embankment subsidence risk during operation of Nghe regular lake

During operation, there must be measures to cope such risks as: (i) Heavy rain, great flood, weak foundation causing embankment erosion; (ii) Embankment cracking, falling during operation phase due to natural reasons or design parameter excess; (iii) Erosion also affecting embankment quality and landscape.

Nghe lake had precast reinforced concrete slabs, slope 1:1. During the embankment operation, there is a risk on embankment subsidence due to: (i) heavy rain, great flood, weak foundation causing embankment erosion; (ii) construction of adjacent infrastructures could cause damage to the embankment; Any incidents of damage to embankments will directly affect the life of local people, environment landscaple and quality of infrastructure located in the area protected by the embankment system.

(iii) Risk of local flooding due to the poor operation and maintenance: As the mentioned in previous section on complete the drainage system on Nguyen Luong Bang and Thanh Binh road

(iv) Risks from the Open Channel System: Some sections of the open channel system will pass through residential areas located along local road parapell with NH5. Thus, there should be protective measures and promulgation of information for avoiding risks for the community living in the project area.

- **Sub-component 1.3: T1 canal embankment and construction of new Lo Cuong pumping station**

(i) Water pollution and decreased lanscape due to direct waste disposal into T1 cannal

As the mentioned under the embankment of Nghe regular lake.

(ii) Bad odor

Bad odor from pumping stations is generated mainly from the treatment units where anaerobic decomposition takes place. Aerobic decomposition also generates offensive odors but at low levels. The main gases generated from anaerobic decomposition consist of H_2S, mercaptan, CO_2, CH_4…, of which H_2S and mercaptan are the main factors causing bad odor and CH_4 poses flammable risk if being cumulated at certain content.

(iii) Embankment subsidence risk during operation of T1 Canal

As the mentioned under the embankment of Nghe regular lake.

- **Sub-component 1.4: The embankment of the Bach Dang river banks (from Tam Giang Bridge to the Dock)**

(i) Water pollution and decreased lanscape due to direct waste disposal into Bach Dang cannal

As the mentioned under the embankment of Nghe lake

(ii) Embankment subsidence risk during operation

As the mentioned under the embankment of Nghe lake

- **Sub-component 1.5: Construction of wastewater collection and treatment system in the west of the city**

(i) Bad Odor from the WWTP and Pumping Station and Aerosols Dispersed from the WWTP

Bad Odor from the WWTP and Pumping Station

Bad odor from the wastewater treatment plant and pumping stations is generated mainly from the treatment units where anaerobic decomposition takes place. Aerobic decomposition also generates offensive odors but at low levels. The main gases generated from anaerobic decomposition consist of H_2S, mercaptan, CO_2, CH_4…, of which H_2S and mercaptan are the main factors causing bad odor and CH_4 poses flammable risk if being cumulated at certain content

Table 3.26: Sulfurous odorous compounds generated by anaerobic decomposition of wastewater

Compound	Formula	Typical odor	Detection threshold (ppm)
Allyl mercaptan	CH_2=CH-CH_2-SH	Strong garlic, coffee smell	0.00005
Amyl mercaptan	CH_3-(CH_2)$_3$-CH_2-SH	Unpleasant, stinky smell	0.0003
Benzyl mercaptan	$C_6H_5CH_2$-SH	Unpleasant, stinky smell	0.00019
Crotyl mercaptan	CH_3-CH=CH-CH_2-SH	Weasel smell	0.000029
Dimethyl sulfide	CH_3-S-CH_3	Smell of decaying vegetation	0.0001
Ethyl mercaptan	CH_3CH_2-SH	Smell of rotten cabbage	0.00019
Hydrogen sulfide	H_2S	Smell of rotten eggs	0.00047
Methyl mercaptan	CH_3SH	Smell of rotten cabbage	0.0011
Propyl mercaptan	CH_3-CH_2-CH_2-SH	stinky smell	0.000075
Sulfur dioxide	SO_2	Unpleasant, allergic	0.009
Tert-butyl Mercaptan	$(CH_3)_3$C-SH	Unpleasant, weasel smell	0.00008
Thiophenol	C_6H_5SH	Stinky smell	0.000062

(Source: *7th International Conference on Environmental Science and Technology – Ermoupolis. Odor emission in a small wastewater treatment plant, 2001*)

Composition of the sulfurous compounds generated from the WWTP basically differs from each other by each treatment process. The anaerobic decomposition generates bad odors but at low level, nearly negligible.

In addition, pumping stations for the WWTP will be constructed in close area so the bad odor can be mitigated.

Aerosols Dispersed from the WWTP

The wastewater treatment plant will generate biological aerosols that can be dispersed into the atmosphere within dozens to hundreds of meter. Aerosols usually contain many kinds of E. coli, entericbacteria, and fungi which are pathogens or induce allergies through the respiratory system. Therefore, the generation and dispersion of biological aerosols can affect the air quality in the environment within the premises of the WWTP.

Table 3.28: Bacteria within the area of the WWTP

Bacteria group	**Value (CFU/m^3)**	**Average (CFU/m^3)**
Total bacteria	0 – 1290	168
E.coli	0 – 240	24
Enterobacteria and other types	0 – 1160	145
Fungus	0 – 60	16

(Note: CFU/m^3 = Colony Forming Units/m^3)

(*Source: 7th International Conference on Environmental Science and Technology – Ermoupolis. Bioaerosol formation near wastewater treatment facilities)*

The volume of bacteria generated from the wastewater treatment plant varies by locations, maximum at the area of the treatment plant and low at far distance.

Table 3.29: Bacteria dispersed from the WWTP

	Bacteria content per 1 m^3 of air			
Distance	0 m	50 m	100 m	>500m
End of wind direction	100 -650	50 -200	5 -10	-
Right of wind direction	100 – 650	10 – 20		

(*Source: 7th International Conference on Environmental Science and Technology – Ermoupolis. Bioaerosol formation near wastewater treatment facilities, 2001*)

This impact only happens within the area of the wastewater treatment plant at low level, unavoidable but manageable.

(ii) Noise from Pumping Stations

Operation of equipment like pump and backup generator will be the source of noise, of which the backup generator will be the main source. Without mitigation measure, during operation, the generator can generate noise level of 90-100dBA at a distance of 1m from the source while allowable limit is only 85 dBA (duration of 8 hours) for production area (Ministry of Health's regulation) and 70dBA for residential area (QCVN 26:2010/BTNMT). However, as described in Chapter 2, pumps are arranged deeply underground and are automatically controlled so there is low risk of human's presence in the area where the noise exceeds allowable limit, or only at a certain time.

(iii) Sludge from the wastewater treatment plant and from the collection and treatment treatment system in the west

Raw wastes, separated from the large-sized coarse and fine screeners, are automatically raked into a container and carried off to be treated as normal solid wastes at Saphin Hai Duong waste treatment plant.

Sludge generated from the WWTP will be about 751 m^3 of dry sludge per year. This volume of sludge would need to be treated with proper measures so as to avoid adverse impacts on the environment. As domestic wastewater normally does not contain hazardous substances, the treatment technology is biotechnology without the use of chemicals. The sludge can therefore be regarded as normal waste and can be used as fertilizer. However, during the operation of the WWTP, it will be necessary to carry out periodic sampling for analysis to ensure this waste is without hazardous substances. In the Southern WWTP, the plant is currently doing research studies to produce fertilizer from these amounts of sludge, but the studies are still in the concept stage. Sanitary means of sludge disposal such as landfill will reduce adverse impacts associated withthe sludge. Therefore, the sludge is still proposed for disposal at Saphin Hai Duong waste treatment plant.

The volume of sludge generated from the WWTP will be transported once every month to Saphin Hai Duong waste treatment plant along Truong Chinh, Ngo Quyen, Thanh Nien street sections connected to National Highway No. 5. Despite the relatively heavy traffic along these streets, the small amount and low frequency of sludge transporting trips will result in negligible impacts. However, sludge transporting trucks must be carefully covered and thoroughly cleaned; otherwise dropping sludge may harm environmental sanitation along the route.

Another problem to be addressed is that the sludge treatment site is quite moist and provides an ideal place for flies and mosquitoes to swarm, reproduce and become a pathogenic source. Spraying to kill flies and mosquitoes is to be carried out in these areas.

The health impact level is assessed to be moderate.

(iv) Impacts on Water quality of Receiving Waterbody

The project will bring positive impacts to the receiving waterbody by collecting and treating the domestic wastewater to meet the standard before discharging into Sat river. The wastewater after treatment will meet QCVN 14: 2008/BTNMT on domestic wastewater quality.

Table 3.27: Water quality after treatment

Parameter	Unit	QCVN 14:2008/BTNMT	
		Column A	Column B
pH	-	5.0 – 9.0	5.0 – 9.0
BOD5	mg/l	30	50
TSS	mg/l	50	100
Total P	mg/l	6	10
NH4+	mg/l	5	10
Coliform	MPN/100ml	3,000	5,000

- ***The Sat river's capacity to receive wastewater***

By the conservation of mass method as in Circular 02/2009/TT-BTNMT dated 19 March 2009, the Sat river's ability to receive wastewater is calculated by following formula:

Waterbody's receiving capacity for polluted effluent	≈	Maximum pollution load of the effluent	-	Existing pollution load in the receiving waterbody

The WWTP under the project is targeted for treating domestic wastewater; therefore, this report only assess the maximum pollution load of typical pollutants in this wastewater, including BOD_5, TSS and Coliform.

- **Maximum pollution load of the pollutant in Sat river**

Maximum pollution load from one typical pollutant source that the waterbody can receive is calculated by formula:

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

Where:

$\mathbf{L_{td}}$ (kg/day) is the maximum pollution load on the water source caused by the considering pollutant;

$\mathbf{Q_s}$ (m^3/s) is the minimum instant flow rate at the considering river section before receiving the wastewater, (m^3/s),

$\mathbf{Q_t}$ (m^3/s) is the maximum flow rate of the wastewater

$\mathbf{C_{tc}}$ (mg/l) is value of concentration limit of pollutants

86.4 is the conversion coefficient from (m^3/s)*(mg/l) to (kg/day).

- Applying the formula for calculating the maximum pollution load: $L_{tđ} = (Q_s + Q_t) * C_{tc} * 86.4$, the maximum pollution loads that the waterbody can receive from the pollutants are:

Parameter	BOD_5	TSS	Coliform	Total P	NH4+
(Qs + Qt) m3/s	1.13888	1.13888	1.13888	1.13888	1.13888
Limited value = Ctc (mg/l)	40.5	81	4050	8.1	8.1
Ltđ (kg/day)	3,985.17	7,970.34	398,516.89	797.03	797.03

- **Calculation of the existing pollution load in the receiving waterbody (Sat river)**

The existing pollution load of a typical pollutant in the receiving waterbody is calculated by the formula:

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

Where:

$\mathbf{L_n}$ (kg/day) is the existing pollution load in the receiving waterbody;

$\mathbf{Q_s}$ (m^3/s) is the minimum instant flow rate at the considering river section before receiving the wastewater,

C_s (mg/l) is the maximum concentration of the pollutant in the waterbody before receiving the wastewater

86.4 is the conversion coefficient from (m^3/s)*(mg/l) to (kg/day).

Parameter	BOD_5	TSS	Coliform	Total P	NH4+
(Q_s) m^3/s	1	1	1	1	1
Maximum value of the concentration = Cs (mg/l)	19.87	39	3900	0.67	1.32
L_n (kg/day)	1,717	3,370	336,960	58	114

- **Calculation of the pollution load of the effluent discharged into the receiving waterbody**

Pollution load of a typical pollutant discharged into the receiving waterbody is calculated by the formula:

$$L_t = Q_t * C_t * 86,4$$

Where:

L_t (kg/day) is the pollution load in the effluent

Q_t (m^3/s) is the maximum wastewater flow rate

C_t (mg/l) is the maximum concentration of pollutant in the wastewater

Parameter	BOD_5	TSS	Coliform	Total P	NH4+
(Qt) m^3/s	0.13888	0.13888	0.13888	0.13888	0.13888
Maximum concentration of pollutant in the wastewater value = Ct (mg/l)	50	100	5000	10	`10
L_t (kg/day)	599.96	1,199.92	59,996.16	119.99	119.99

- **Calculation of wastewater receiving capacity**

Waterbody's capacity to receive a pollution load of a typical pollutant from an individual discharge point is calculated by the formula:

$$L_{tn} = (L_{td} - L_n - L_t) * F_s$$

Where:

L_{tn} (kg/day) is the waterbody's capacity to receive pollution load;

F_s is the safety factor =0.4 (applicable for waterbodies as river, lake, pond)

Parameter	BOD_5	TSS	Coliform	Total P	NH4+
Ltd (kg/day)	3,985.17	7,970.34	398,516.89	797.03	797.03
Ln (kg/day)	1,717	3,370	336,960	58	114

Parameter	BOD_5	TSS	Coliform	Total P	NH4+
Lt (kg/day)	599.96	1,199.92	59,996.16	119.99	119.99
Ltn (kg/day)	667.38	1,360.33	624.29	247.66	225.20

Thus, in case of incident taking place for one day, 12,000 m^3 of untreated wastewater are fully discharged into Sat river. Then, in the most unfavorable circumstance, Sat river is still able to receive the waste source for the parameters of BOD_5, TSS, Coliform, Total P and NH_4. The receiving capacity of Sat river over the time of the incident is calculated as follows:

Parameter	BOD_5	TSS	Coliform	Total P	NH4+
Ltn(kg/d)	667.38	1,360.33	624.29	247.66	225.20
Lt (kg/d)	599.96	1,199.92	59,996.16	119.99	119.99
No. of days of failure (day)	0.9	0.9	96.1	0.5	0.5

Based on the data on the amount of pollutants from wastewater into the waste source and the receiving capacity of Sat River, it is possible to calculate the number of days of incident on which Sat river is still capable of receiving the aforesaid pollution parameters, respectively: BOD5 in 0.9 days, TSS in 0.9 days, total P in 0.5 days and NH4 in 0.5 days.

(v) Domestic Waste and Hazous Waste

Domestic Waste from the WWTP

During the wastewater treatment plant's operation, there will be domestic waste generated by operating workers. Total domestic solid waste is estimated to be 18 kilograms per day and domestic wastewater is generated about 2.4 m^3/day with assumption that the solid waste generation coefficient is 1.5 kg/person/day; wastewater generation coefficient is 200 liter/person/day; number of operating workers: 12 workers.

Wastes from Pumping Stations

During operation, the wastewater pumping station will generate a very small volume of wastes most of which are hazardous waste, including:

- Oil and fuel leaked during the maintenance of equipment
- Oily cloth during the maintenance of equipment.

This amount of waste is small and is generated in a short time. It will also be collected by workers for proper storage and treatment.

(vi) Environmental Hazard and System Failure Risk

Waste discharge incidents due to possible emergencies and WWTP failure

Incidents likely to occur during the operation of the WWTP of the subproject include:

- Fire and explosionof which the causes may be due to short-circuiting, fire and explosion of chemicals used in wastewater treatment;
- Power outage disrupting the operation of the WWTP;
- Malfunctioning of one of the works of the treatment system forcing stoppage of the operation, affecting the entire wastewater collection system of the city, in which

casewastewater may overflow the wastewater pumping stationsand overwhelm the pavements, causing localized flooding, thus damaging and causing environmental pollution;

- Other incidents which may force the WWTP to stop operating: in such an emergency, untreated wastewater has to temporarily be discharged into the Sat river. As a result the receiving waters would be exposed to high risks of contamination from this source of wastewater. However, based on the canculation above, the data on the amount of pollutants from wastewater into the waste source and the receiving capacity of Sat River, Sat river is still capable of receiving the untreated wastewater if emergency discharge is not avoidable, specifically : BOD5 in 0.9 days, TSS in 0.9 days, total P in 0.5 days and NH4 in 0.5 days.

Chemical leakage

During the WWTP operation, chlorine will be used in disinfection. Therefore, there might be risks of chlorine leakage if there are problems with the operator or management is poor. Chlorine leaked into the environment would endanger anyone getting into contact with it. At low concentrations, chlorine can bring about cause breathing difficulties, cough, nausea, skin burns or eye burns. A high concentration of 250ppm and an exposure of 30 minutes can really kill. Therefore, during the operation process, it is imperative to have measures of prevention against such risks. The impact level is assessed to be medium.

Broken and blocked pipelines

Without being dredged periodically, sludge accumulating in the wastewater collection sewers can block sewers, reducing wastewater transmission capacity. Any sewer segment, if blocked, will be likely to force accumulated wastewater overflow onto other areas, causing environmental pollution.

Heavy rains in the area would wash solid waste on the roads down into the drainage sewers, tertiary pipelines, and wastewater collecting sewers via manholes, reducing drainage capacity of the system.

The incident of breaking joints, water and wastewater pipelines may pollute to the groundwater (for the wastewater pipeline) and causes the subsidence, affecting to infrastructures such as roads, people's housing. Therefore, there must be plans on periodic checking and repairs. The impact level is regarded as low.

Fire and explosion

Fire andexplosion incidents could occur due to short-circuiting, lightning strikes… in the areas of the WWTP and the stormwater and wastewater pumping stations, possiblycausing damages to people and properties. Therefore, fire and explosion prevention measures will be speciallyaddressed.

Operators' health

Operators are mainly present at the WWTP and the stormwater pumping stations. The main impacts on them in these areas are mostly noise from pumps, mal odors, and bacterial infection from treatment units and the sludge treatment area. However, with sufficient protective gear and compliance with technical operating procedures, these risks will be minimized.

Incidents at pumping stations

During operation, problems related to pumping stations may arise such as malfunctioning or power cutoff disrupting the operation of the stations. In such instances, wastewater will accumulate and possibly overflow to outer environment, causing pollution. Or, with heavy rains, stormwater may be confined and cause flooding and inundation in the city.

The impact level is assessed to be medium.

3.2. Social Impact Assessment

3.2.1. Positive impacts

The project is expected to have significant positive social impacts in Hai Duong City for people living in the project area by upgrading urban infrastructure (roads, drainage, water supply and sanitation, public facilities, and power supply) based on community priorities. The project covers 10 wards of Hai Duong city and will bring benefits to 231,662 people. Besides positive impact, the project also bring negavite impacts like: land acquisition, resettlement, loss of livelihood, social illness…

3.2.2. Negative impacts

- *Impacts on resettlement:* Results of the Inventory of losses show that, 90 households will be affected by the project, of which 35 households will be affected in term of structure. There are two vulnerable households (one policy household and one poor household). 15 business households will be affected under the construction of the Bach Dang river embankment item. No ethnic minority household will be affected. No households will be relocated so the level of impact is low. Affected households are presented in following table:

Table 3.30: Summary and Classification of Affected Households

No.	Work item	Affected HH	Affected agency/ organization	Vulnerable HH	Relocated HH	Severely affected HH
1	Complete the drainage system on Nguyen Luong Bang and Thanh Binh road	0	0	0	0	0
2	Improvement of drainage system in the North of the railway	2	0	0	0	0
3	T1 canal embankment and Lo Cuong Pumping station	10	1	0	0	0
4	Bach Dang river embankment	78	0	2	0	0
5	Environmental sanitation improvement	0	1	0	0	0
Total		**90**	**3**	**2**	**0**	**0**

(*Source: Inventory of Losses)*

- *Impact on land :* The project will affect 7,691.91 m^2 of land, including 668.1m^2 residential land, 478.81m^2 pond land, 1,545m^2 canal land under CPC's management and 5,000m^2 of landfill under management of Hai Duong City Transport Company. As a result, project's impact of land

loss is relatively small. The project will also provide livelihood restoration program and training courses to support those who lose their income, especially vulnerable groups.

Table 3.31: Affected land area of Hai Duong Urban subproject

No	Work item	Residential land (m^2)	Pond land	Canal land	Landfill	Total ($m^{2)}$
1	Complete the drainage system on Nguyen Luong Bang and Thanh Binh road	0	0	0	0	0
2	Improvement of drainage system in the North of the railway	49.93	0	0	0	49.93
3	T1 canal embankment and Lo Cuong Pumping station	0	455	1,545	0	2,000
4	Bach Dang river embankment	618.17	23.81	0	0	641.98
5	Environmental sanitation improvement	0	0		5.000	5.000
	Total	**668.1**	**478.81**	**1,545**	**5,000**	**7,691.91**

(Source: Inventory of Losses)

- Impact on Crop and Vegetation: The project will affect crops and vegetation including: (i) 1,200 fruit trees, (ii) 2,020 timber trees. Main impacts are summarized in table 3.32.

Table 3.32: Impact on crops/vegetation and trees

No	Work item	Fruit trees (trees)	Timber trees (trees)
1	T1 canal embankment and Lo Cuong Pumping station	450	520
2	Bach Dang river embankment	750	1.500
	Total	**1.200**	**2.020**

(Source: Inventory of Losses)

3.2.2.1. Impact on livelihood

The project will bring negative impacts on livelihood. Impact on business households along the transport route, construction and relocated business households: relocation may affect the income and livelihood of the household doing business. The project will bring negative impacts on livelihood. Impact on business households along the transport route, construction and relocated business households: relocation may affect the income and livelihood of the household doing business. For those who do small business, hairdressing, nailing. when being relocated in another place, maybe they will get difficulties to maintain their previous jobs (due to market, location). The project has 15 business households being affected. Most of HHs don't have registered busines.

3.2.2.2. Impacts due to laber influx

It is estimated that the subproject would mobilize about 230 workers, many of whom would be hired locally in the subproject local communities. Therefore, worker camps would be required for only about 150 workers, contractors, and engineers at the different construction sites. It is expected that the biggest worker camps would be for about 50 workers during peak construction

periods. Due to limited construction activities and areas, worker camps may not be required for construction of the storm water pump station, stormwater and wastewater sewers, tertiary sewer lines. The main potential social problems associated with worker camps could be: (i) potential impact of spreading infectious disease from employees to local communities and vice versa; (ii) potential impact of prostitution, drugs and gambling; (iii) potential conflict between workers and local communities because of differences of culture, behavior; and iv) sexual abuse and assault of girls due to influx of workers employed by the construction company in the area. However, with the shortage of labor for the construction, local workers in the city will have the opportunity to participate in the construction. Therefore, the impact is assessed as moderate.

3.2.2.3. Gender Issues

The project brings many risks, specialy for women:

- Men and women often experience the impacts of land acquisition and resettlement in different forms and to different extents by nature of their gendered roles in society. Women tend to bear greater burdens in loss of livelihood and disruption to social networks.
- Female-headed households (number) face additional challenges associated with resettlement, especially when they are reliant on extended family and social networks for the care and socialization of children.
- Women are also more susceptible to the risks of HIV/AIDS infection compared to men.
- Women are often managing home based business.

3.2.2.4. Risks of social ills

High concentration of workers in the construction site with high percentage of male workers and temporary residents, business and entertainment activities can generate complicated social ills like prostitute, heroine addiction. Some social diseases like HIV/AIDS, HBV, HAV can happen and spread.

3.2.2.5. Impacts in Traffic System

During the construction process, a large amount of soil, rock, sand, construction materials and equipment will be transported to the area planned for construction. This will increase a huge amount of vehicles on the roads, affecting traffic capacity on the roads, causing traffic jam in peak hours and potential risks of traffic accidents.

3.2.2.6. Conflicts on benefits and impacts on local economy

- For the economy: The construction of the project items will concentrate about 230 workers during peak periods, increasing the demand for foods in the locality, contributing to the promotion of services .
- For the management system of local government: The construction of the project will attract free migrants to the project area, this will be the cause of social evils. This impact will be controlled by the contractor.
- For people: illegal immigrants and construction workers can bring strange diseases and spread to local people and vice versa. At the same time, their activities can pollute water

and air, facilitating the development of diseases, especially common diseases such as malaria, diarrhea, yellow fever ... affecting the health of construction workers and the people. This impact can be controlled by the contractor.

3.3. Cumulative Impact Assessment

Cumulative impacts are the environmental and social effects of a project in combination with the effects of other existing projects and/or projects that are being carried out, or are reasonably foreseeable, in respect of specific components of the environment and social conditions. The assessment focuses on the effects of concurrent construction and operation of the subproject with other spatially and temporally proximate projects to ensure that the cumulative impacts are identified and evaluated in an integrated manner in the area of Hai Duong City. As such, this cumulative analysis relies on a list of related projects that have the potential to contribute to cumulative impacts in the subproject area of influence.

Geographic Scope

Cumulative impacts are assessed for related projects within a similar geographic area. This geographic area may vary, depending upon the issue area discussed and the geographic extent of the potential impact. For the purposes of this analysis, review of the projects in and around the subproject area has found no reasonably foreseeable, on-going, and future projects within the subproject area.

Project Timing

In addition to the geographic scope, cumulative impacts also take into consideration the timing of related projects relative to the proposed subproject. For this analysis, other past, present, and reasonably-foreseeable future construction projects in the area have been reviewed and found that there were no recent past projects, projects being implemented, or projects to be executed in the City in foreseeable future.

Therefore, it can be concluded that there would be no cumulative impacts from other projects in combination with the proposed subproject.

3.5. Induced impacts

Induced development can be a positive as well as negative cumulative impact. If not planned to conform to local physical plans, it can lead to urban sprawl along improved Nghe lake, T1 cannal and Bach Dang river. However, this impact can be manageable if proper planning adopted. The positive induced impacts however will outweigh the negative ones. It is foreseeable that the land value will increase along improved areas therefore land-use will significantly changed in the surrounding areas. Specifically, current agriculture land along T1 canal and Bach Dang river will be subjected to residential land as according to the City Master Plan. Undoubtedly, the local government and the community will be benefited from the land value capture financing. This is one among many other benefits that the urban upgrading project will bring.

CHAPTER 4. ANALYSIS OF ALTERNATIVES

Hai Duong city is the economical, political, social and cultural center of Hai Duong province, which is the central hub of the Northern Key Economic Zone on the northern economic corridor. In order to make Hai Duong city become one Grade I city in 2020 and to follow the Spatial Zoning Planning with three large spaces namely the Tourism- Industry – Urban Center in the Northern Middlands and Mountainous area, the Central Delta area (including Hai Duong city) and the Industry – Urban Center in the Southern Delta area, the DCIDP expects to improve urban technical infrastructure, enhance planning and urban management capacity in the future basing on the approved plans and decisions as follows:

- Decision No.490/QĐ-TTg dated 5th May 2008 by the Prime Minister approving the planning on construction of Hanoi capital region up to 2020, with a vision toward 2050.
- Decision 445/QĐ-TTg dated 7th April 2009 by the Prime Minister approving modification of the master plan for development of Vietnam's urban system by 2025 with vision to 2050
- Decision No.3155/QĐ-UBND dated 15th November 2011 by Hai Duong Provincial People's Committee approving Hai Duong regional planning.
- Decision No.1960/QĐ-UBND dated 4 July 2017 by Hai Duong Provincial People's Committee approving the modification of Hai Duong city's Master Plan by 2030, with a vision to 2050.
- Official Document No.4850/VPCP –QHQT by the Office of Government dated 11th May 2017 approving the proposal of "Medium Cities Development Project – Hai Duong City, Hai Duong Province".
- Official Dispatch No.5303/BKHĐT-KTĐN dated 29th June 2017 by the Ministry of Planning and Investment requesting for the support and identification of the "Medium Cities Development Project – Hai Duong City, Hai Duong Province".

During the project impact assessment, analysis of alternatives is a very important phase which aims to determine project location, scope, design and specific technologies applicable to the project to maximize positive impact while minimizing negative impacts. The analysis of alternatives is conducted for individual component of the project under close cooperation among stakeholders. Results of the analysis are presented as follows.

4.1. "Without Alternatives" Scenario

Without the project, Hai Duong City will continue to face the challenges of lacking of proper urban technical infrastructure and resilience to climate change and sea level rise. This can be worse when the city's population continues to increase due to increased birth rate and immigration of neighboring labors coming to the City for jobs in the industrial parks. The City will no longer be an attractive area for living and there will be a great migration from the City to other places in the future. Challenges include:

- The City's roads and drainage systems have been degraded or incomplete because they were constructed long time ago. Some areas even do not have wastewater collection and treatment system.

- Water supply system has not been rehabilitated, leading to water stagnant and possible inundation.

- Wastewater and waste increase, polluting the environment.

The "with project" and "without project" scenarios are analyszed in Table 4.1 for each project's component to address main positive impacts of each investment.

Table 4.1: Analysis of Alternatives under the "With project" and "Without project" Scenarios

Work item	With project	Without project
Drainage system (on Nguyen Luong Bang, Thanh Binh roads and in the North of the railway)	- Localized inundation will be reduced - People's transport will be imporved, road system will be upgraded - Environmental sanitation will be improved - Road surface will be restored, sidewalk and tree system will be rehabilitated - People's living condition will be improved - Nghe lake will become a reservoir, draiange system and tree system around the lake will be rehabilitated. - Local land value will increase	- Localized inundation will still exist. Drainage system is just concrete ditch which was constructed long time ago, only temporarily contain water - People's transport condition will not be improved. Road surface will be still degraded - Environmental sanitation and pollution will not be solved and will increase by time. - People's living condition will not be improved. - South-North drainage system from the railway to the NH5 does not work effectively, causing localized inundation. - Canal system will no longer be effective. There will be no compensating reservoir. - Land value will not increase. - There will be no resettlement issue
Embankment (T1 canal embankment, construction of Lo Cuong pumping station)	- Drainage will be improved in the west of the city. - Drainage in the central city area will be ensured. - Technical infrastructure for the central area will be completed. Land erosion and river encroachment will be prevented. - Road sidewalk, tree system on the road will be rehabilitated, facilitating people's movement. - Lighting system will be built along the road. - Environmental sanitation will be improved	- Localized inundation will still exist hindering people's transport. - The existing pumping station's capacity is low, not meeting the drainage demand. - The canal section from Thanh Nien road to Bui Thi Xuan road has not been solidly embanked. There are land erosion and encroachment at some sections, affecting urban aesthetic - There is no wastewater collection system. - Wastewater is directly discharged to the rivers, polluting environment. - People's living condition will not be improved
Construction of the wastewater collection and treatment system	- Wastewater on the whole inner city area will be collected and treated - Environmental sanitation will be improved. People will have better	- There is no separate drainage system. - The wastewater treatment plant does not work effectively, only at

Work item	With project	Without project
(in the West of the City)	living condition. - People's responsibility and awareness on environmental protection will be raised.	small scale, not meeting demand.

4.2. "With Alternatives" Scenario

In this scenario, the analysis of alternatives refers to the different technical design options for upgrading the infrastructure system. The analysis will consider technical, economic, environmental and social aspects of the options.

4.2.1. Alternatives for the drainage system

4.2.1.1. Drainage system on Thanh Binh and Nguyen Luong Bang roads

Proposed options for upgrading technical infrastructure on Thanh Binh and Nguyen Luong Bang roads include:

(a) Option 1: Laying sewer on the road's both sidewalks, repaving road surface and rehabilitating sidewalks.
(b) Option 2: Laying sewer under the roadbed, restoring road surface and rehabilitating sidewalks.

Detail analysis for alternatives are presented in Table 4.2 below.

Table 4.2: Alternatives for drainage system in Thanh Binh and Nguyen Luong Bang roads

Aspect	Option 1	Option 2 (to be selected)
Technical	- Good collection capacity - Only suitable with new construction works (limited sidewalk and road area) - Simple but slow construction because it requires restoration of the existing technical infrastructure - Convenient operation and maintenance because the system is laid on the road surface	- Very good collection capacity - Suitable with rehabilitated and newly constructed work - Simple and quick construction because it will not be affected by the existing infrastructure system - More difficult operation and maintenance because the system is laid under the roadbed
Social	- Mainly pedestrians on the sidewalks are affected by the construction - People's transport and living condition will be improved - There will be no resettlement issue	- It will require separation of transport lane during the construction - People's transport and living condition will be improved - There will be no resettlement issue
Environmental	- Localized inundation will be reduced - Environmental sanitation in will be improved - There will not be much environmental impacts, only in construction phase	- Localized inundation will be reduced - Environmental sanitation in will be improved - There will not be much environmental impacts, only in construction phase
Economic	- Low construction cost	- Medium construction cost

Aspect	Option 1	Option 2 (to be selected)
	- Local land value will increase	- Local land value will increase

Conclusion: The above table is the general analysis of the two options. In option 1, the installation of sewer on two sidewalks is usually suitable for the project where new roads are constructed with limited cross section and equipped with drainage system. In addition, this option is constrained by the availability of existing technical infrastructure, which can lead to delays in construction time. Option 2 has average construction cost, higher than Option 1; However, the construction method is simple, water collection capacity is higher and suitable for rehabilitation projects. This option's disadvantage is that its control and maintenance will be more complicated than Option 1 because it is laid underground. By analyzing and considering advantages/disadvantages in all mentioned aspects of the proposed options, Consultant proposes to select: **Option 2 – Laying reinforced concrete sewer under the roadbed.** This is because the sidewalk already accomodates may infrastructure works, no more space for an additional system. Arrangement of the drainage sewer on the sidewalk is not feasible because it will require displacement of great volume of the existing infrastructure works.

4.2.1.2. Drainage system in the North of the railway

Upgrading the drainage system in the North of the railway needs to use pump for the two booster pumping stations to bring water from the ditch to the drainage pumping stations in the Catchment area No.2. There are 3 proposed options for pump:

(a) Option 1: Axial flow pump
(b) Option 2: Horizontal centrifugal pump
(c) Option 3: Submersible pump.

Detailed analysis of the alternatives is presented in Table 4.3 below.

Table 4.3: Alternatives for the drainage system in the North of the railway

Aspect	Option 1	Option 2	Option 3 (to be selected)
Technical	- Rather popular for drainage purpose in primary pumping station. - Good independent operation, the motor is submersible in the water - Rather high reliability, but the pump impeller can be blocked by garbage - Compex management and repair because it requires lifting up entire pump out of water - Requiring rather large pump house because the pump size is large	- Popular, particularly used in civil and household pumping purposes - Not very good independent operation, not submersible in the water, requiring priming for the pump - High reliability, stable operation, high strength, less maintenancee - Convenient management and repair - Requiring large pump house, isolating from the suction area	- Popular both in water supply, drainage and sewerage pumping - Good independent operation, submersible in the water - High reliability, stable operation, high strength, less maintenancee - Compex management and repair because it requires lifting up entire pump out of water - Simple and compact pump house
Social	- People's living condition will be improved - There will be no resettlement issue	- People's living condition will be improved - There will be no resettlement issue	- People's living condition will be improved - There will be no resettlement issue

Aspect	Option 1	Option 2	Option 3 (to be selected)
Environmental	- Solving the inundation for the area between the railway and NH5 - Environmental sanitation in will be improved - There will not be much environmental impacts, only in construction phase	- Solving the inundation for the area between the railway and NH5 - Environmental sanitation in will be improved - There will not be much environmental impacts, only in construction phase	- Solving the inundation for the area between the railway and NH5 - Environmental sanitation in will be improved - There will not be much environmental impacts, only in construction phase
Economic	- Medium construction cost	- High construction cost	- Low construction cost

Conclusion: For Option 1, axial-flow pump is a widely used, well-operated and reliable type of pump with average construction cost; However, the system requires a relatively large area of land and its maintenance and repair will be complicated because of its large size. Option 2 is popular, has convenient contral and maintenance, high durability but it also faces with many limitations such as high construction cost, requiring large house area and has low operating capacity. Option 3 has the lowest investment cost with simple structure, good independent operation but maintenance will be difficult because the system requires to lift the pump up. By analyzing and considering advantages/disadvantages in all mentioned aspects of the proposed options, Consultant proposes to select: **Option 3 - Submersible pump** for the investment to save the land budget, not to affect NH5.

4.2.2. Alternatives for embankment

4.2.2.1. T1 canal embankment

The canal is narrow and only takes the function of drainage so only simple and available embankment options will be compared. There are 3 options for the embankment lining:

(a) Option 1: Vertical embankment lining by stone.
(b) Option 2: Vertical embankment lining by pre-stressed reinforced concrete piles.
(c) Option 3: Slope embankment lining by precast concrete slabs.

Detailed analysis of the alternatives is presented in Table 4.4 below.

Table 4.4: Alternatives for T1 canal embankment

Aspect	Option 1 (to be selected)	Option 2	Option 3
Technical	- Medium construction method (requiring high skilled workers) - Medium construction progress (depending on water level during construction). - Medium stability (the wall is high, able to cause instability) - Medium suitability (depending on availability of high skilled workers)	- Simple construction method (requiring specialized equipment for transporting and constructing the retaing wall) - Fast construction progress (not depending on water level during construction) - Good stability - Low suitability, not very popular (only applicable to some works at narrow	- Simple construction method - Medium construction progress (depending on water level during construction) - Medium stability (the sloping wall is high, able to cause localized instability) - High suitability - High aesthetics, high reliability

Aspect	Option 1 (to be selected)	Option 2	Option 3
	- High aesthetics, medium reliability - Convenient operation and maintenance	construction space, requiring little site clearance due to high cost) - High aesthetics, high reliability - Convenient operation and maintenance	- Convenient operation and maintenance
Social	- People's living condition will be improved - There will be no resettlement issue	- People's living condition will be improved - There will be no resettlement issue	- People's living condition will be improved - There will be no resettlement issue
Environmental	- Improving drainage capacity and preventing inundation for residential area in the west of the city - High environmental impact (due to transportation of material and construction of revetment and retaining wall)	- Improving drainage capacity and preventing inundation for residential area in the west of the city - High environmental impact (due to impacts from piling work and transportation)	- Improving drainage capacity and preventing inundation for residential area in the west of the city - Medium environmental impact
Economic	- Low construction cost	- High construction cost	- Medium construction cost

Conclusion: The canal is small, is only used for drainage purpose simple and available embankment options will be compared. Among the three mentioned Options, Option 1 has the lowest construction cost but its construction method, stability, suitability are normal while its environmental impact is high. Option 2 has the highest construction cost, limited suitability and also has rather high environmental impact during its piling work and transportation. However, Option 2 has simple construction method and good stability. Option 3 has medium construction cost, high suitability, normal construction method and stability. Therefore, in summary, **Option 1 – Vertical embankment lining by stone** will be selected thanks to its lowest construction cost.

4.2.2.2. Lo Cuong pumping station

Upgrading the drainage system in the North of the railway needs to use pump for the two booster pumping stations to bring water from the ditch to the drainage pumping stations in the Catchment area No.2. There are 3 proposed options for pump:

(a) Option 1: Axial-flow pump.
(b) Option 2: Horizontal centrifugal pump
(c) Option 3: Submersible pump.

Detailed analysis of the alternatives is presented in Table 4.5 below.

Table 4.5: Alternatives for Lo Cuong pumping station

Aspect	Option 1 (to be selected)	Option 2	Option 3
Technical	- Rather popular for drainage purpose in primary pumping station. - Good independent	- Popular, particularly used in civil and household pumping purposes - Not very good	- Popular both in water supply, drainage and sewerage pumping - Good independent

Aspect	Option 1 (to be selected)	Option 2	Option 3
	operation, impeller is submersible in the water, not requiring priming - Rather high reliability, but the pump impeller can be blocked by garbage - Compex management and repair because it requires lifting up entire pump out of water - Requiring rather large pump house because the pump size is large	independent operation, the pump is not submersible in the water so it requires priming - High stability, stable operation, high strength, not requiring much maintenance - Convenient operation and repair - Requiring large pump house, isolating from the suction area	operation, the pump is submersible in the water, not requiring priming - High stability, stable operation, high strength, not requiring much maintenance - Difficult operation and repair because it requires lifting up the entire pump out of water. - Simple and compact structure
Social	- People's living condition will be improved - There will be no resettlement issue	- People's living condition will be improved - There will be no resettlement issue	- People's living condition will be improved - There will be no resettlement issue
Environmental	- Improving drainage capacity for the city, particularly the catchment area 2 - Improving environmental sanitation for residential area along the T1 canal - There will not be much environmental impacts, only in construction phase	- Improving drainage capacity for the city, particularly the catchment area 2 - Improving environmental sanitation for residential area along the T1 canal - There will not be much environmental impacts, only in construction phase	- Improving drainage capacity for the city, particularly the catchment area 2 - Improving environmental sanitation for residential area along the T1 canal - There will not be much environmental impacts, only in construction phase
Economic	- Medium construction cost	- High construction cost	- Low construction cost

Conclusion: The above table reflects general assessment for the options. However, to select pump and pump house structure, it is required to consider all aspects of: working environment, technical conditions of flow, pump head, type of liquid; space, land budget and location; The pump capacity will be fully and effectively promoted whent it is used properly. For Option 1, axial-flow pump is a widely used, well-operated and reliable type of pump with average construction cost; However, the system requires a relatively large area of land and its maintenance and repair will be complicated because of its large size. Option 2 is popular, has convenient contral and maintenance, high durability but it also faces with many limitations such as high construction cost, requiring large house area and has low operating capacity. Option 3 has the lowest investment cost with simple structure, good independent operation but maintenance will be difficult because the system requires to lift the pump up. However, under this project, the pump will be used mainly for drainage purpose in a large catchment area, so **Option 1 – Axial-flow pump** will be selected for Lo Cuong pumping station.

4.2.3. Alternatives for the wastewater collection and treatment system

There are 3 options proposed for the wastewater collection and treatment system in the West of the city as follows:

(a) Option 1: Combined drainage system.
(b) Option 2: Separate drainage system.
(c) Option 3: Semi-separate drainage system.

Selection of the option will affect technological line and the treated water quality. The three proposed options will be analyzed as follows:

Table 4.6: Alternatives for the wastewater collection and treatment system

Aspect	Option 1	Option 2 (to be selected)	Option 3
Technical	- Taking advantage of the existing drainage system, reducing investment cost - The system can work both in rainy and dry seasons - Unstable operation. In rainy season, water flow rate is high while in dry season water flow rate is low, leading to sedimetnation - Simple management	- Suitable with new urban areas and cities not having drainge system - In dry season, the sewer system does not operate, leading to waste - Complex management because there will be two drainage systems	- Making use of the existing drainage system, minimizing excavation work - Suitable with the urban areas or city already having draiange system - The sewerage interceptor from the overflow to the treatment system has to be burried rather deeply. This is at the end of the main sewer so it requires construction of transaction pumping stations - Rather complex management
Social	- People's living condition will be improved - There will be no resettlement issue	- People's living condition will be improved - There will be no resettlement issue	- People's living condition will be improved - There will be no resettlement issue
Environmental	- Not thoroughly collecting and treating wastewater, polluting the environment	- Ensuring the best sanitation because wastewater is thoroughly collected and treated - The system is arranged reasonably. Rainwater and wastewater is separated convenient for inundation prevention, treatment and environmental protection	- Rather good environmental sanitation because wastewater is completely colleected and treated
Economic	- Lowest construction cost - The pumping station has very large capacity, leading to high operation cost	- High initial investment cost. Requiring construction of two completely separate drainage systems	- Not very high initial investment cost - Reducing cost for site clearance and compensation

Conclusion: Option 1 of using a combined drainage system which can pollute the environment is an inappropriate option for the project. For Option 2, due to the fact that there is no existing drainage system in the West of the city, this system will be suitable for this option. The system also ensures the quality of water for environmental sanitation and supports to prevent flooding

during storms. However, investment cost for Option 2 is relatively high. Option 3 has the lowest investment capital and can completely collect and treat wastewater, protecting the environment. However, Option 3 is only suitable for the area where there is already drainage system. Management of system in the Option 3 will also be very complicated. Therefore, in conclusion, **Option 2 - Separate drainage system** will be selected based on the following factors: (i) Technical, Environmental and Social aspects of each option; (ii) Existing status of the drainage system; (iii) Budget for the project implementation; (iv) the collection area is mainly new urban areas, not having drainage system.

4.2.4. Alternatives for technological line for the wastewater treatment plant

Based on the requirement for the effluent quality before dicharging into the receiving waterbody (type B), location of the treatment plant, requirement for the distance (about 150 m) as well as the local socio-economic condition, then the activated sludge technology is the most suitable for the wastewater treatment plant. Some technologies are compared, including:

(a) Option 1: Standard Aerotank technology.
(b) Option 2: Sequence Batch Reactor (SBR).
(c) Option 3: Food Chain Reactor (FCR).

Table 4.7: Alternatives for techology line for the wastewater treatment plant

Aspect	Option 1	Option 2	Option 3 (to be selected)
Technical	- Filtering organic matters by aeration, using activated sludge - Popular application - Rather complex operation - Rather large construction area - Poor aesthetics - Large applicable capacity range	- Filtering and oxidizing organic matters in the aeration tanks, removing solids by using membrance - Popular application - Complex operation and management, using manu automatic equipment - Requiring small construction area - Poor aesthetics - Reducing operation load by using standard activated sludge	- Wastewater circulates through different aerobic tanks forming “food chain reaction”. Higher level micro-organism eat lower-level micro-organism. - Popolar application at different areas, areas with few works - Rather complex operation and management. - Requiring smaller construction area than the convensional activated sluge technology. - High aesthetics - Large applicable capacity range
Social	- People’s living condition will be improved - Convenient site clearance - There will be no resettlement issue	- People’s living condition will be improved - Convenient site clearance - There will be no resettlement issue	- People’s living condition will be improved - Convenient site clearance - There will be no resettlement issue
Environmental	- Rather high environmental impact, short distance from the residential area, L=300m	- Rather high environmental impact, short distance from the residential area L=300m	- Rather high environmental impact, short distance from the residential area L=50m

Aspect	Option 1	Option 2	Option 3 (to be selected)
			- Not causing bad odor
Economic	- High construction cost - High management cost	- High construction cost - High management cost	- High construction cost - Low management cost

Conclusion: The three mentioned options all help to improve the quality of people's life by providing wastewater treatment system and they will not cause many resettlement issues. However, the environmental impact of the three options is relatively high due to the short distance from the plant to the residential area. Option 1 and 2 have relatively high construction and management costs, complex operation, poor aesthetics. Option 2 requires a small construction area but it is only suitable for systems with small and medium capacity. Therefore, in conclusion, Option 3: **Food Chain Reactor (FCR**) will be selected because it not only share the similar advantages with Option 2 but also has low management cost, requiring small construction area, popular application and high aesthetics.

CHAPTER 5. ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES

5.1.ENVIRONMENTAL IMPACT MITIGATION MEASURES

5.1.1. General principles

In order to minimize adverse environmental impacts, many measures haven been proposed since the preparation stage of the subproject. Surveys and design activities have been prepared with many alternatives to minimize the subproject's impacts during construction and operation processes. During the preparation of the subproject, effort has been made to avoid potential adverse impacts on resettlement and land acquisition by reducing scope and/or modification of the basic design of the subproject investment. In developing the mitigation measures, the strategies to minimize and/or rectify the impacts have been applied and where appropriate compensation has been incorporated. The proposed mitigation measures to reduce the impacts due to land acquisition and resettlement are described. The following principles have been adopted in devising the mitigation measures:

- Disturbance to the life and transportation of the local people must be minimized.

- The proposed measures must be environmentally and socio-economically feasible.

- Technical standards and regulations must be abided by.

- Construction equipment and methods must be environment-friendly.

- Monitoring activities must be conducted on a regular basis.

This chapter identifies mitigation measures of the key subproject impacts during the pre-construction and construction (including measures integrated into detailed technical design, site clearance, ground levelling, construction, and restoration) and operation phases. Given that most of the key impacts will occur due to civil works and transportation of construction/waste materials, many 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, water, waste, etc. Since there are specific impacts, this chapter also address the site-specific measures both during the construction and operation phases.

5.1.2. Measures to be integrated into the detailed technical design

The following measures will need to be included in the detailed technical designs of the works items during subproject implementation.

Sub-component 1.1: Completion of technical infrastructure on Nguyen Luong Bang and Thanh Binh roads

- The design of a reinforced concrete drainage system has been calculated on the basis of surveys on hydrologic regimes (flood levels, flow regimes, etc.), topography and geology of the area to

ensure the safety and effective operation of the drainage system along the Nguyen Luong Bang and Thanh Binh road.

- Laying reinforced concrete sewer under the roadbed is selected for Nguyen Luong Bang, Thanh Binh road with the length of L= 5.01km and 3.84km respectively based upon the actual condition is that the sidewalk already accommodates infrastructure works, no more space for an additional system.

Sub-component 1.2: Rehabilitation of rainwater drainage system in the north of the railway

- The design of the embankment for Nghe lake has been calculated on the basis of surveys on hydrologic regimes (flood levels, flow regimes, etc.), topography and geology of the area to ensure the safety and effective operation of the embankment.
- The design of a drainage system has been calculated on the basis of surveys on hydrologic regimes (flood levels, flow regimes, etc.), topography and geology of the area to ensure the safety and effective operation of rainwater drainage system in the north of the railway.

- Trees would be planted along Nghe lake to improve the landscape (10m/ tree)

Sub-component 1.3: Lining embankment for T1 canal and constructing new Lo Cuong pumping station

- The design of the embankment has been calculated on the basis of surveys on hydrologic regimes (flood levels, flow regimes, etc.), topography and geology of the area to ensure the safety and effective operation of the embankment.
- The two sides of T1 canal will build 3m-width roads by cement concrete with the function of operation management. The roads with sidewalk will be renovated to facilitate transportation for citizens.
- The roads will have energy-saving lighting systems to ensure people's safety during night and aesthetic beauty.

Sub-component 1.4: Lining embankment on two banks of Bach Dang river (from Tam Giang bridge to the dock)

-The design of the embankment has been calculated on the basis of surveys on hydrologic regimes (flood levels, flow regimes, etc.), topography and geology of the area to ensure the safety and effective operation of the embankment.

Sub-component 1.5: Constructing the wastewater collection and treatment system in the west of the city

- The design of the wastewater collection and treatment system has been calculated on the basis of surveys on the demand of wastewater treatment, hydrologic regimes (flood levels, flow regimes, etc.), topography and geology of the area to ensure the safety and effective operation of the system.
-The quality of water after treatment must comply with the Type B of the National Technical

Regulation on domestic wastewater QCVN 14/2008/BTNMT.

-The treatment method of Food Chain Reactor (FCR) will be applied for the wastewater treatment system. Advantages of FCR are requirement of short distance between residental area and WWT (L=50m); causing bad odor less than other treatment technology; low management cost (using less electric and reducing sludges about 60% comparing with the traditional treatment technology).

5.1.3. Measures to Mitigate Impacts during Pre-Construction

During the project preparation, the resettlement consultant, technical consultant and PMU have worked together to analyze the alternative options and select the most suitable design based on the principle of (i) minimizing the resettlement due to land acquisition and (ii) mitigating impacts of land acquisition and resettlement.

Implementation of the project will affect 90 households, of which none will need to be relocated, 03 organizations,and 02 vulnerable households in Hai Duong city. The total land will be affected is 7,691.91 m^2, including as 668.1m^2 residential land, 478.81m^2 pond land, 1,545m^2 canal land under CPC's management and 5,000m^2 of landfill under management of Hai Duong City Transport Company. Moreover, the project will affect house and structure of 35 households. It is equivalent with 3,510$m^{2,}$ of house, 85m^2 of breeding facilities, 960m^2 of yard and 1,560m^2 of fence. It is also important to mention that the project will affect crops and vegetation consisting of 1,200 fruit trees and 2,020 timber trees. Mitigation measures will be applied so there will be no relocation of cultural and historical works and relics.

Overall, the estimated cost for the Resettlement Action Plan of the subproject is approximately 58,958,000,000 VND (equivalent to 2,591,577 USD at the exchange rate of 22,750 VNĐ = 1 USD). Of which:

Description	Quantity	Amount (VNĐ)
I. Land		**19,822,792,900**
1. Residential land	668.1	19,329,700,000
2. Aquacultural land	478.81	43,092,900
3. Landfill	5000	450,000,000
II. Structure		**28,730,954,858**
1. House	3,510	24,611,909,400
2. Fence	1,560	2,161,692,000
3. Yard	960	4,800
4. Breeding facilities	85	234,515,000
5. Compensation for underground electricity (5%)		1,230,595,470
6. Compensation for tap water (2%)		492,238,188
III. Tree		**1,184,000,000**
1. Fruit tree	1,200	780,000,000
2. Timber tree	2,020	404,000,000

Description	Quantity	Amount (VNĐ)
Sub-total I		**49,737,747,758**
IV. Assistance		**2,000,120,000**
1. Assistance for life subsistence	90	861,120,000
2. Assistance for business establishment	15	150,000,000
3. Assistance for vulnerable households	2	6,000,000
4. Incentive bonus	90	900,000,000
5. Transportation in the ward	18	63,000,000
Sub-total II		**51,737,867,758**
V. Other cost		
1. Implementation (2%)		1,034,757,355
2. Independent monitoring (2%)		1,034,757,355
3. Contingency (10%)		5,173,786,776
VII. Total		**58,958,369,244**
Rounded		**58,958,000,000**
Exchanged to USD	22,750	**2,591,577**

(Source: RP report, Oct 2017)

The budget for the resettlement is taken from Hai Duong PPC counterpart fund and will be allocated promptly and sufficiently against the resettlement schedule.

Mitigation of UXO Risks

The subproject owner (the subproject PMU) will sign a contract with the military civil engineering agency or Hai Duong Provincial Military Base for UXO detection and clearance at the construction sites. UXO clearance will be executed right after the completion of site compensation and before the implementation of demolition and ground leveling. The estimated cost is approximately 50 million VND/ha. No construction activity will be allowed until the UXO clearance is completed.

5.1.4. Measures to Mitigate Impacts during Construction

5.1.4.1. Generic Impact Mitigation Measures

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. Scope and content of the ECOPs is as follows:

Scope: Construction activities for small works governed by these ECOPs are those whose impacts are of limited extent, temporary and reversible, and readily managed with good construction practices.

The typical general impacts which are minimized by the mitigation measures defined in ECOPs include: (1) Dust, exhaust gases emission, impacts of the noise and vibration; (2) wastewater management; (3) Solid waste control; (4) Hazardous waste; (5) Water pollution control; (6) Methods for controlling the impacts on aquatic species and biological creatures; (7) Controlling effects on the urban landscape and aesthetics; (8) Controlling methods of sediments, erosion and floods; (9) Land subsidence and land slide control; (10) Traffic safety control; (11) Controlling the influence to the existing infrastructures and services; (12) Controlling the social impacts; (13) Controlling the impacts on cultural and religious structures; (14) Safeguard measures for the public health; (15) Safeguard measures for the workers' health.

Component 1 encompasses 5 sub-components: (i) Completion of technical infrastructure on Nguyen Luong Bang and Thanh Binh roads; (ii) Rehabilitation of rainwater drainage system in the north of the railway; (iii) Lining embankment for T1 canal and constructing new Lo Cuong pumping station; (iv) Lining embankment on two banks of Bach Dang river (from Tam Giang bridge to the dock); (v) Constructing the wastewater collection and treatment system in the west of the city.

5.1.4.2. Site -Specific Impact Mitigation Measures

The impact assessments on the construction of rainwater drainage, embankment and wastewater treatment system are shown in Chapter 3. In order to mitigate the site specific impacts arising from the drainage system, dredging, embankment and wastewater treatment construction, the Contractors shall take the following measures.

Table 5.1: Site-specific mitigation measures during construction phase

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
1	**Sub-component 1.1: Drainage and flood prevention**	
a	**Localized flooding** - Residents along the Nguyen Luong Bang and Thanh Binh road - Residents in Thanh Binh and Viet Hoa wards	- PMU will ensure that detailed design will consider adequate temporary drainage to avoid potential flooding during construction - The contractors must apply the specific construction methods, and flood prevention and control alternatives during construction period or the flow diversion alternatives to ensure proper drainage in that area - The contractors must set up temporary drainage system at the construction site and ensure that it is cleared of mud and other obstructions - Have a standby pumps for rapid drainage in case of heavy rain or extreme weather events
b	**Transport hinderance and impacts on business activities** - Local peopel and local business along the Nguyen Luong Bang and Thanh Binh road - Residents in Thanh Binh and Viet Hoa wards	- Ensure that the contract requires the contractor, before commencing work, to provides a construction plan with a detailed heath, safety, environment and traffic management plan - Inform local residents in advanced (at least 07 days) about construction and work schedules, interruption of services, traffic routes. - Put and maintain bulletin boards at the construction site, containing the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work. - Construction is carried out in a sequencing manner, section by section in a short period of time. Avoid the simultaneous construction and delay all over the construction activities - Contractors should provide lighting at a construction site at night; security guard staff at construction sites to regulate vehicles go out and in the construction site; - Put the road construction warning signs at the site all the time. - Avoiding the waste/material transportation during rush hours; - Construction by night time is not allowed - Limit the construction area; the construction activities are only taken in the site boundary - Assign staff to guide the traffic during transportation, unloading, and loading.
c	**Impact on Physical Cultural Resources (PCRs) and Sensitive receptors** Hai Duong Medical College (70 m from Nguyen Luong Bang road); Hai Duong Medi-Tech Universtiy Hospital (Adjoining Nguyen Luong Bang road) and Hai Duong Tuberculosis and Lung Disease Hospital	***Impact on schools:*** - Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction - Construction area to be marked with warning signs to prevent pupils and unauthorized people from entering. - Teachers to be informed of construction operations to keep pupils off the site during their break

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
	(adjoining Thanh Binh road)	time. - Prohibit use of construction methods that cause noise during school learning hours. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes when children go to and leave the school. - Do not load construction materials within 20m from school and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at end of the working day. - Immediately address any issue/problem caused by the construction activities and raised by the schools ***Impact on hospitals :*** - Inform the hospital management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction - Construction area to be marked with warning signs to prevent and unauthorized people from entering. - Prohibit use of construction methods that cause noise at night - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes when doctors, nurses and patients go to and leave the hopital. - Do not load construction materials within 20m from hospital and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at end of the working day. - Immediately address any issue/problem caused by the construction activities and raised by the hospital
2	**Sub-component 1.2: To rehabilitate the rain water drainage system in the north of the railway**	

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
a	Local flooding - Residents living around Nghe lake, - Residents in Cam Thuong, Binh Han and Viet Hoa wards	- PMU will ensure that detailed design will consider adequate the rain water temporary drainage to avoid potential flooding during construction - The Contractors must apply the specific construction methods, and flood prevention and control alternatives during construction period or the flow diverson alternatives to ensure the drainage in the location. - Set up a temporary sewers to ensure drainage at the construction site. - Arranging the standby pumps for rapid drainage in case of heavy rain or extreme weather incidents.
b	Odors from dredging process, and nuisance and leakage during the transportation of 67,531m^3 sediments from Nghe lake - People living along Nghe lake - Residents in Cam Thuong, Binh Han and Viet Hoa wards	***Management of sediments generated during dredging process: 67,531 m^3 sediments from Nghe lake*** - The Dredged Materials Management Plan (DMMPs) for the dredging Nghe regular lake has been prepared. Overall, excavated materials will be disposed at Sapharie domestic waste treatment plant or being used for agricultural or tree planting purpose based on actual needs of the local people. The DMMP is described in details in chapter 6 – Environmental and Social Management Plan and and Annex 1. - Ensure that detailed design of canal dredging will include the update of DMMP with additional analysis of sediment quality, detailed information on the amount of generated sediment, requirements on contractor's dredging method, transportation and disposal that are appropriate and cost-effective. The updated DMMPs will be incorporated into the related bidding documents and contracts - Prior to construction, the contractors shall have a specific DMMP based on the updated DMMP. The contractor's DMMPs shall be submit by Construction Supervision Consultant for approval before starting the work. The dredging plan will indicate volumes, physical-chemical-biological properties of dredged material, dredging procedures, temporary gathering of dredged materials, and control of polluting material during temporary gathering and transportation, pollution control, and risks at disposal sites. - Manage to ensure sediments will be disposed appropriately according to the approved DMMP. ***To control impacts by odors from dredging process:*** - Sediments materials will be collected along the work sites and covered by the technical fabric to limit slurry leaking into the soil, and transported for disposal within the day. The management plan on dredged materials will be prepared to instruct the contractors to manage the waste source. - Uncontrolled disposal of the dredged sludge is prohibited. The waste source must be managed properly under the supervision of PMU.

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
		- In order to limit the impacts of odor of the dredged sludges, the workers shall be equipped with the masks, boots and gloves when working in/exposing to these waste sources. - Spraying EM (Effective Microorganisms) every day. The deodorants can eliminate malodors from H_2S, CH_4, etc. - Dredged materials will be collected, transported and treated by contracts in the the Sapharin waste treatment plant (landfill site). Transportation of the dredged sludge must meet the environmental protection requirements and avoid slurry leakage; the sludge carrying trunks must be covered closely and not overloaded as permitted.
c	**Impact on PCRs (Han pagoda and cemetary**	- Inform Han Pagoda/cemetary of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - The contractor shall coordinate with local authorities (leaders of local wards or communes) for agreed schedules of construction activities at sensitive times (e.g., religious festival days). Avoid construction activities during religious events every first and 15^{th} days of the lunar month and during festival days if possible. - Pile driving activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management. - Environmental training for the workers includes codes of conducts when working in public areas and sensitive receptors such as pagodas. - The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to local people and goers to pagoda. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the pagodas. - Truck drivers shall restrict horning in areas close to the pagoda area - Immediately address any issue/problem caused by the construction activities and raised by the pagodas.
d	**Vibration impacts and risk on infrastructure collapse to Han Pagoda**	- The contractor should provide evidences proving all equipment and machineries used in the project have been tested and complied with the current Vietnamese Regulations on Vibration from construction activities as specified in the QCVN27:2010/BTNMT; - The construction method shall include the measures to protect the foundation of the fence/gate, of the Han pagoda, such as using supporting pillars or steel frame to prevent the risk on infrastructure collapse/damage.

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
		- The contractor should take photos at the initial sate of the construction sitel. In case damages happen, the contractor should take full responsibility in compensating or reconstructing the broken facilities as agreed with the pagoda.
3	**Sub-component 1.3: T1 canal embankment and construction of new Lo Cuong pumping station**	
a	**Impact on on aquacultural production of T1 canal during dry dredging process**	- The dredging operation is conducted only during the dry season; - Create sedimentation traps and maintain them periodically to ensure that most solids in surface runoff are retained in the traps before entering the existing drains or water sources surrounding the sites; - Leachate from sediments must be first deposited in sedimentation hole/trap before entering the canals. - Strictly prohibit contractors to discharge waste into T1 canal - Upon forecasted stormy weather, suspend all the construction activities, tidy up the sites, brace and protect the materials and construction machines. - Do not gather construction materials as well as machinery and equipment near the stream. Gathering small quantities of materials, fit with the schedule. Materials must be covered with tarpaulin, avoiding the upwind location, near the canal. - Strictly prevent hazardous waste, waste oils or particularly greasy rags from entering the flow.
b	**Odors from dredging process, and nuisance and leakage during the transportation of 6,400 m^3 sediments from T1 cannal** **- People living along T1 cannal** **- Residents in Tu Minh ward**	- As the mentioned in sub- component 1
c	**Impacts on Inland Waterway**	- Coordinate with the local authority to inform local people on the construction plan prior to construction; - Coordinate with the Department of Inland Waterway to flag the signal system on the inland waterway the transport travel through; - Place warning boards along the construction route, both on land and water surface (arrange the road and waterway traffic guide).
d	**Impact on Aquacultural Production**	- Informing the community of the construction schedule at least one week before the construction. - Arrange drainage around the construction sites to ensure no soil erosion and sedimentation to the aquacultural area in Sat river near Lo Cuong pumping station.

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
		- Regularly check the aquacultural area to ensure construction spoils and wastes do not block them. - Closely consult with the local community to ensure that suitable solutions to problems are taken and communities concerns related to construction activities are addressed. - In case damages happen, the contractor should take full responsibility in compensating loss.
e	**Impact on Agricultural Land and Fruit-tree Plantation**	- Informing the community of the construction schedule at least one week before the construction. - Arrange drainage around the construction sites to ensure no soil erosion and sedimentation to Agricultural Land and Fruit-tree Plantation. - Provide alternative water diversion from canal to the locations the local people requested, if they are affected. - Regularly check the affected fish ponds to ensure construction spoils and wastes do not block them. - Closely consult with the local community to ensure that suitable solutions to problems are taken and communities concerns related to construction activities are addressed. - In case damages happen, the contractor should take full responsibility in compensating loss.
f	**Risks on soil erosion, embankment subsidence, house cracking during embankment**	- Ensure that the detailed design for the embankment includes hydrological and geological surveys to ensure sustainability and stability of the embankment; - Ensure that the detailed design and contractor's construction method take into account the risk on local house cracking - Before dredging, reinforcement of banks will be conducted. This construction method must be proposed and submitted to the authorities concerned for approval by the construction contractors. - Ensure that land acquisition and house relocation at the site boundary is completed piror to commencing construction work - Use construction method to reduce vibration for construction activities of embankment i.e. pipe jacking instead of pile driving; closely monitoring the vibration level; - Construction of side slope is made in accordance with the design - Do not carry out dredging works in rainy season. - Do not place heavy machineries and transportation vehicles near the canals banks. Inspection and supervision on land subsidence risks must be taken regularly in order to prepare the appropriate reinforcement plans.
g	**Impacts on the PCRs:** *Lo Cuong temple*	***Impacts on Lo Cuong temple***

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
	(about 30m from Lo Cuong pumping station and T1 canal); **Impact on sensitive receptors:** *Thanh Dong university (about 300m from T1 canal); the medical station in Tu Minh ward (about 150 m from T1 canal)*	- Inform Lo Cuong temple of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - The contractor shall coordinate with local authorities (leaders of local wards or communes) for agreed schedules of construction activities at sensitive times (e.g., religious festival days). Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. - Pile driving activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management. - Environmental training for the workers includes codes of conducts when working in public areas and sensitive receptors such as pagodas. - The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to local people and goers to pagoda. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the pagodas. - Truck drivers shall restrict horning in areas close to the pagoda area - Immediately address any issue/problem caused by the construction activities and raised by the pagodas. ***Impacts on school :*** As the mentioned in sub- component 1 ***Impacts on medical station:*** As the mentioned in sub- component 1
4	**Sub-component 1.4: *Lining embankment on two banks of Bach Dang river (from Tam Giang bridge to the dock)***	
a	**Impact on Ecosystem and Mollusca Output**	- The dredging operation is conducted only during the dry season; - Create sedimentation traps and maintain them periodically to ensure that most solids in surface runoff are retained in the traps before entering the existing drains or water sources surrounding the sites; - Leachate from sediments must be first deposited in sedimentation hole/trap before entering the Bach Dang river.

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
		- Strictly prohibit contractors to discharge waste into Bach Dang river - Upon forecasted stormy weather, suspend all the construction activities, tidy up the sites, brace and protect the materials and construction machines. - Do not gather construction materials as well as machinery and equipment near the stream. Gathering small quantities of materials, fit with the schedule. Materials must be covered with tarpaulin, avoiding the upwind location, near the canal. - Strictly prevent hazardous waste, waste oils or particularly greasy rags from entering the flow.
b	**Landslide on Bach Dang river banks**	- Ensure that the detailed design for the embankment includes hydrological and geological surveys to ensure sustainability and stability of the embankment; - Ensure that the detailed design and contractor's construction method take into account the risk on local house cracking - Before dredging, reinforcement of banks will be conducted. This construction method must be proposed and submitted to the authorities concerned for approval by the construction contractors. - Ensure that land acquisition and house relocation at the site boundary is completed piror to commencing construction work - Use construction method to reduce vibration for construction activities of embankment i.e. pipe jacking instead of pile driving; closely monitoring the vibration level; - Construction of side slope is made in accordance with the design - Do not carry out dredging works in rainy season. - Do not place heavy machineries and transportation vehicles near the canals banks. Inspection and supervision on land subsidence risks must be taken regularly in order to prepare the appropriate reinforcement plans.
c	**Impact on local bridge**	- Inform the local people of the construction activities and their potential impacts such as waste, dust, and noise, traffic, especially vibration, risk of cracking on overpass and construction schedule at least 02 weeks before start of the construction. - To use construction method that cause less vibration for construction activities of embankment; - Stabilize and reinforce the canal banks in the vicinity of small bridge over Bach Dang river (located about 200 m from the end ternimal of Bach Dang river) prior to the dredging and embankment. - Do not utilize heavy machineries while dredging near the small overpassing bridge. - Place safety signs and provide proper detour instructions on each of the dredging segment that crosses the small bridge

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
		- If damage to the bridges happens, a temporary access shall be provided for the local residents. The damage bridges shall be repaired or adequate compensations shall be made upon agreement with affected households and local community.
d	**Disruption of business activities**	- Inform the street household businesses of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - Set up construction and traffic warning signs at the construction site. - Provide safe and easy acces to the household businesses putting clean and strong thick wood panels or steel plates over the open ditches. - Do not gather materials and wastes within 20m from household businesses and shops. - Do not use machines generating loud noise and high vibration levels near the businesses. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Deploy staff to guide the traffic during construction, transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cleaning up construction areas at the end of the day, especially construction areas in front of business shops. - Providing night lighting system with luminously painted fence and night lamp. - Manage the worker force to any avoid the conflict with the local people and traders. - Compensate goods, products damaged by construction activities of the subproject. - Immediately address any issue/problem caused by the construction activities and raised by the local household traders.
e	**Odors from dredging process, and nuisance and leakage during the transportation of 6,400 m^3 sediments from T1 cannal** **- People living along T1 cannal**	As the mentioned in sub- component 1
5	**Sub-component 1.5: Construction of the wastewater collection system in the west of the city**	
a	**Impact on Ecosystem and Fishery**	- Create sedimentation traps and maintain them periodically to ensure that most solids in surface

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
	Output	runoff are retained in the traps before entering the existing drains or water sources surrounding the sites; - Leachate from sediments must be first deposited in sedimentation hole/trap before entering the Sat river or ponds around WWTP area - Strictly prohibit contractors to discharge waste into Sat river and ponds around WWTP area. - Upon forecasted stormy weather, suspend all the construction activities, tidy up the sites, brace and protect the materials and construction machines. - Do not gather construction materials as well as machinery and equipment near the stream. Gathering small quantities of materials, fit with the schedule. Materials must be covered with tarpaulin, avoiding the upwind location, near the canal. - Strictly prevent hazardous waste, waste oils or particularly greasy rags from entering the flow. - Regularly check the affected fish ponds to ensure construction spoils and wastes do not block them. - Closely consult with the local community to ensure that suitable solutions to problems are taken and communities concerns related to construction activities are addressed. - In case damages happen, the contractor should take full responsibility in compensating loss.
b	**Impact on Existing Infrastructure**	- In case the project need temporary land acquisition during construction duration, compensation for affected standing crops/trees and income lost during period of temporary acquisition must be paid to PAP. - Compensation Policy for damages of private or public structures occurring during construction execution. - Damaged property will be restored to its former condition or compensated by contractors, immediately when occurred; - Under their contract specifications, the contractors will be required to take extreme care to avoid damaging property during their construction activities. Where damages do occur, the contractor will be required to repair the damage and may also be required to pay compensation to the affected families, groups, communities, or government agencies at the same compensation rates that are applied to all other assets affected by the Project.
c	**Impact on the PCRs:** Dong Nien temple (35 m from Booster pumping station No. 5); Co Hoai temple (30 m from Booster pumping station No.	***Impacts on Dong Nien, Co Hoai temple and Cam Khuc Pagoda*** - Inform Pagodas and Temple of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - The contractor shall coordinate with local authorities (leaders of local wards or communes) for

No	Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures
	10); Cam Khuc Pagoda (22 m from Booster pumping station No. 22) **Impact on sensitive receptors**: Nhi Chau kindergarten (50 m from Booster pumping station No. 1); Viet Hoa kindergarten (10 m from Booster pumping station No. 5) Tan Binh kindergarten (1 m from Booster pumping station No. 16) Tu Minhkindergarten (20 m from Booster pumping station No. 21) Local market (15 m from Booster pumping station No. 24)	agreed schedules of construction activities at sensitive times (e.g., religious festival days). Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. - Pile driving activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management. - Environmental training for the workers includes codes of conducts when working in public areas and sensitive receptors such as pagodas. - The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to local people and goers to pagoda. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the pagodas. - Truck drivers shall restrict horning in areas close to the pagoda area - Immediately address any issue/problem caused by the construction activities and raised by the pagodas. ***Impacts on kindergartens :*** As the mentioned in sub- component 1 ***Impact on Local market:*** - Limiting to transport materials/wastes (for constructing the items of Booster pumping station) when passing by Local Market at the peak hours (morning: 5-9h; noon: 11-12h; afternoon and evening: 16 - 19h), which does not create any obstacles to the travelling/business activities of the residents. - Spray sufficient water to suppress dust during dry and windy days at least two times a day at road along the market area. - Inform household businesses/market's management unit of the construction and transportation activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at lt 02 weeks before start of the construction.

Mitigation measures for impacts on traffic and traffic safety due to transportation of construction materials and wastes:

During construction, under sub-component 1-5, a number of sreets and roads will be affected by transportatin of construction materials and waste as indicated in Table 5.2 below.

Table 5.2. Material and waste transport routes

Construction site	Expected length (km)	Roads for spoil transportation
Sub-component 1.1: Drainage and flood prevention	20	30/10 → Truong Chinh → Thanh Binh → Nguyen Luong Bang → Ngo Quyen → NH5
Sub-component 1.2: To rehabilitate the rain water drainage system in the north of the railway	18	Phan Dinh Phung →NH5
Sub-component 1.3: T1 canal embankment and construction of new Lo Cuong pumping station	23	Vu Manh Hung → Tu Minh → NH5
Sub-component 1.4: Lining embankment on two banks of Bach Dang river (from Tam Giang bridge to the dock)	15	Cau Com →Tam Giang → Thanh Nien, Tran Hung Dao → NH5
Sub-component 1.5: Construction of the wastewater collection system in the west of the city	18	Vu Cong Dan → Tu Minh, Thuong Dat →NH5

Mitigation measures for impacts include:

- Clean up the transport vehicles before leaving construction site. 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.
- Do not park vehicles in the roads longer than necessary. Do not allow construction vehicles and materials to encroach upon the pavements.
- Maintain the required speed limit and do not overuse horn.
- Periodically registry and supervise the quality of transport vehicles as required by the government regulations.
- Comply with the traffic safety regulations while participating traffic
- Clean up wastes dropped off on road.
- Assign staff to guide the traffic during transportation, unloading, and loading of construction materials, equipment, and wastes.
- Place stockpile materials at a designated place tidily and successively according to construction schedule.
- Spray water three times per day to reduce dust during dry days if required.
- Reinstall the road surface if occurring the damages during construction.

5.1.5. Measures to Mitigate Impacts during Operation

- **Sub-component 1.1: Drainage and flood prevention**

Mitigation Measures for Risk of local flooding due to the poor operation and maintenance

To minimize impacts by the status of blockage of drainage system due to inadequate maintenance during operation phase of Thanh Binh and Nguyen Luong Bang road; the O&M units will be implemented mitigation measures follow:

- The management of storm water drainage along the roads should be focused and examined regularly to detect the congested drainage sewer sections and carry out dredging.
- Conduct periodic planning decentralization and dredging sewer sections and manholes in order to minimize the flow congestion (every 6 months).
- Control disposal of sludge: Similar to the construction phase, those who manage the water drainage systems would have contracts with relevant authorities of sludge dredging from the sewer sections and manholes and then transport to the landfill by specialized tank trucks to avoid odor emission and spillage during transportation.

Sub-component 1.2: To rehabilitate the rain water drainage system in the north of the railway

Measures to prevent embankment subsidence risk during operation of Nghe regular lake

- To avoid risk on embankment cracking and subsidence, in detailed design should be implemented hydrology and geological surveys to ensure sustainable and stable designs
- City shall provide O &M Plan as well as budget source should be approved and arranged by the City.
- Ensure the city's operations and maintenance plan, and related budget, includes the work and resources required to maintain the embankment periodically
- Closely monitor the construction of other infrastructures within the area that potentially affect the embankment structures

Measures for the status of direct waste disposal into the Nghe regular lake

- During the O&M, to control risks of pollution and flow stagnation due to disposal of waste from households living along the canals, the O&M unit will be implemented mitigation measures follow:
- Cooperating with the local government to disseminate information on hygiene practices to the people, and prohibiting to release wastes into the canals; PMU and DONRE should be in collaboration to impose much more serious penalty to polluter
- Properly arranging the waste baskets along the canal and launching programs of increasing awareness of the community toward environmental protection;
- Carrying out periodical dredging and clearing works of the canals at least 6 months/time especially before the wet season;
- Signing contracts with the responsible agencies on collecting, transporting and treating dredged sludge.

Mitigation Measures for Risk of local flooding due to the poor operation and maintenance

- Cooperating with the local authorities to disseminate information on hygiene practices to the people, and prohibiting to release wastes into the drainage systems
- Carrying out periodical clearing works of the drainage systems.
- Sweeping and cleansing pavements must include clearing the rubbish and obstructing objects on the flow/sewer inlets/heads;

Mitigation Measures Risks from the Open Channel System:

- Cooperating with the local authorities to disseminate information on hygiene practices to the people, and prohibiting to release wastes into the drainage systems
- Sweeping and cleansing pavements must include clearing the rubbish and obstructing objects on the flow/sewer inlets/heads;

- **Sub-component 1.3: T1 canal embankment and construction of new Lo Cuong pumping station**

Measures the status of direct waste disposal into the T1 cannal

As the mentioned under the embankment of Nghe regular lake.

Measures to prevent embankment subsidence risk during operation of T1 cannal

As the mentioned under the embankment of Nghe regular lake.

- **Sub-component 1.4: Lining embankment on two banks of Bach Dang river (from Tam Giang bridge to the dock)**

Measures the status of direct waste disposal into the Bach Dang embankment

As the mentioned under the embankment of Nghe regular lake.

Measures to prevent embankment subsidence risk during operation of the Bach Dang embankment

As the mentioned under the embankment of Nghe regular lake.

- **Sub-component 1.5: Construction of the wastewater collection system in the west of the city**

Odor control

- The following measures are required to prevent, minimize, and control air emissions and odors during operation:
- Domestic waste and sludge generated during the operation of the plant will be safely collected by specialized tank trucks and transported away by URENCO to serve the planting of urban green trees or to be dumped at landfill of the town. This will reduce bad odors generated from sludge;
- There will be plans to periodically test and monitor air concentrations to obtain proper evaluation and control operation processes in a logical manner.

Sludge

- Practical experience shows that, sludge generated from domestic wastewater treatment plants can be used for production of organic fertilizer after it is dewatered because it does not contain heavy metals, industrial waste and high organic content. Therefore, it can be used as fertilizer for plants. This use is only allowable if the sludge content meets QCVN

03: 2015/BTNMT: National technical regulation on heavy metals content in soil. When the dredged sludge contains many heavy metals, Employer and operator of the facility will contract with the hazardous waste treatment (possibly Sapharin Hai Duong Waste Treatment Plant) to handle the sludge pieces.

- Hai Duong URENCO will be employed to periodically dredge sludge from sewer systems and transport this sludge for disposal at landfill. Transportation will be carried out by specialized tank trucks to avoid odor emission and sludge spillage along the route

Domestic Wastewater

- Domestic wastewater from the WWTP will be pretreated through 3 compartments of septic tanks before being discharged into combined sewers and will be directed to the treatment area.
- Measures to minimize impact on receiving water
- An online monitoring system is to be installed at the WWTP for controlling the wastewater inflow, quality of the influent and effluent at the WWTP;
- The quality of sample effluent from the WWTP must be analyzed once every 3 months;
- Treatment facilities are to be periodically checked and maintained to ensure highest performance of the system;
- Troubleshooting plans must be prepared to respond promptly to incidents in due time (standby generators, standby pumps, discharge incident) in order not to disrupt the operation of the plant;
- Based on an assessment of risks to human health and the environment, consider re-use of treated effluent, especially in areas with limited raw water supplies. Treated wastewater quality for land application or other uses should be consistent with the relevant public health-based guidance from the World Health Organization (WHO) and applicable national requirements

Hazardous Waste

- The subproject owner will register as the owner of hazardous waste according to Circular No. 36/2015/TT-BTNMT dated 30 June 2015 on hazardous waste management;
- Containers of hazardous waste are to be placed on flat floors without tilting, tumbling, and must be free from stormwater infiltration. Collected hazardous waste will be stored in containers/houses and labeled as currently stipulated. Packaging materials for chemicals will be returned to the suppliers;
- Once every 2-3 months, the WWTP will have to employ a local contractor tasked with handing hazardous waste to collect, transport and handle such waste;
- Empty chlorine containers are to be returned to manufacturers

Environmental Hazards and System Failure Risk (Broken and Blocked pilines)

Regular inspection: including external and technical inspections.

- External inspection means the inspection on the state of manhole, lids, waste water levels in culverts, garbage in the manhole, land subsidence along the culverts, inappropriate connection between the main and branch pipes, land slides into the well, surface water penetrating into the culvert, etc. The inspection will be conducted once a month.
- Technical inspection: This is to detect the technical status and hydraulic conditions of the network. Workers will go down the inspection pits to check and identify damages in the network and in the pits, the filling of culverts, the need to clean the network, the penetration of surface water and groundwater into culvert. Technical inspections will be conducted twice a year. After the inspection is completed, damages will be listed and recored in technical documents for technical repair or major repair.

+ To clean the culvert: To ensure the drainage capacity of the network, it is necessary to thoroughly cleans the culvert system. This cleansing will be carried out regularly at least once a

year and usually 2-3 times a year. Sediment deposited in the culvert is not allowed to exceed 1/3-1/4 culvert diameter. Culvert cleansing can be done by hydraulic and mechanical methods.

- Hydraulic method: This method utilize flow velocity to wash the sediment in the culvert. The flow velocity will be increased by increasing the flow of water into the culvert. Use a water truck having spray fountains with water flowrate of 5 l/s.

- Mechanical method: To input dredging tools into the culvert to dredge. Sediment is removed through the manholes. This method is only used when the hydraulic method is not effective or not cost-effective. In case that the culvert is blocked due to improper use, culvert should be cleaned. Culvert can be cleansed by using steel wire or bamboo to poke into the culvert to remove sediment and wash by water.

+ Network repair:

- Minor repairs will be conducted when the network gets small failures, which do not affect its normal operation. Minor repairs include: changing hooks, changing manhole/pit lids, welding seam in the pits, rebuilding the pits, repairing valve accessories…
- Basic repairs will be conducted to repair the damage caused to the network which requires excavation of road surface (i.e. lowering the pits due to the depth of the connecting branches, the blocked culvert not able to be cleansed and requiring reconstruction; culverts between the pits are broken, damaged, pits are broken…). Basic repairs include removal and resetting of culverts, construction of additional culvert, etc.
- To perform basic repairs, it is sometimes necessary to interrupt the network's operation at the section that needs repair. Therefore, the top priority is to ensure continuous operation of the upstream section by temporarily using a suction pump to suck water from the upstream pit to pour to the downstream pit or by using temporary ditches.

CHAPTER 6. ENVIRONMENTALAND SOCIAL MANAGEMENT PLAN

Based on the assessments of the potential adverse environmental impacts and mitigation measures proposed in Chapter 3 and chapter 5 of this report, this Chapter presents an Environmental and Social Management Plan (ESMP) for Hai Duong project. EMP identifies the measures to be carried out for the project, including environmental monitoring program and implementation arrangements, taken into account the needs to comply with the government's EIA regulations and WB's environmental safeguard policies, including Environmental, Health, and Safety (EHS) Guidelines of the WB.

6.1. BASIC PRINCIPLES

In order to ensure that all pollution sources 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 are executed in a scientific, systematic and regular manner. Below is a summary of environmental impacts, mitigation measures and responsibilities of stakeholders.

ESMP's mitigation measures are divided into 3 basic parts: (1) ECOP, (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 work 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 projects to minimize impacts such as noise, dust, vibration, waste generation, traffic hindrance, public safety, etc. In this context, an ECOP has been prepared to describe the specific requirements to be carried out by contractor to mitigate the subproject potential impacts which are considered as the general ones (Section 6.2.1). The contractors will also be required to mitigate site-specific impacts which will be identified in order to address specific issues of the subproject.

(2) In addition to adopting the ECOPs, the specific mitigation measures have been identified (Section 6.2.2) for addressing the impacts associated with the specific types of structures under the subproject. These measures will be included in the contracts for corresponding packages.

(3) All the specific impacts on each sensitive place of which mitigation measures could not be addressed through implementation of the ECOPs, shall be solved by the site-specific mitigation measures. (Section 6.2.4). Measures to mitigate impacts from land acquisition and resettlement are mentioned separately in the Resettlement Action Plan (RAP) and those measures will be carried out and supervised separately.

6.2. KEY IMPACT MITIGATION MEASURES

6.2.1. ECOPs

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 control; (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 health and safety; (14) Measures to secure worker's health and safety, (15) Management of warehouses and borrow pits, (16) Communication to local community.

Table 6.1: Environmental Codes of Practices for addressing general construction impacts (ECOPs)

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
1. Generated dust, noise, vibration and exhaust gas	• 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 25^{o}C, or in windy weather. Avoid overwatering as this may make the surrounding muddy. • Exposed soil and materials shall be protected against wind erosion and the location of materials 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 20m^{3}within barriers or covered so as to avoid dust dispersion. • Transport wastes out of construction sites to the designated locations for	• 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
	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 such as the areas for Nghe lake, Bach Dang river, T1 cannal or WWTP • Periodically wash the trucks used for transporting materials and construction wastes. • Avoid construction operations generating great vibration and loud noise within the time between 6pm and 7am when construction takes place near residential areas. Night construction must be informed to the community at least 2 days in advance. • Perform the method of successive construction for each sewer section in construction sites of long sewer lines. • Observe and secure construction progress correctly. • Set up 2.5m-high fences of corrugated iron around the construction sites such as the areas for the Nghe, Bach Dang and T1 embankment and WWTP. • 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.	• QCVN 14:2008/BTNMT: National technical regulation on domestic	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	• 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 Nghe, Bach Dang and T1 embankment and WWTP. • 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 Nghe, Bach Dang and T1 embankment and WWTP. • 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.	wastewater; • QCVN 40: 2011/ BTNMT: National technical regulationon industrial wastewater		
3. Solid waste 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	• Decision No, 59/2007/NĐ-CP on garbage management; • Decision No,38/2015/NĐ-CP dated 24/04/2015 on waste and scrap	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	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 dispose at Seraphin Hai Duong Waste Treatment Plant. • 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 Seraphin Hai Duong Waste Treatment Plant 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	management		

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	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. • The Contractor will sign a contract with Hai Duong Urban Environment Joint Stock Company 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.			
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	• 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
	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			
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 Nghe, Bach Dang and T1 embankment and WWTP. • 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 Nghe, Bach Dang and T1	• QCVN 09-MT:2015/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:	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	embankment and WWTP. • 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	General requirements for concentrated wastewater treatment plants		
6. Impacts on plants and aquatic species	• The Contractor shall prepare a Clearance, Revegetation 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	• Law on environmental protection No. 55/2014/QH13	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	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.			
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**.**	• 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,	• Avoid disturbances and damage to the existing vegetation and green trees.	• TCVN 4447:1987: Construction regulation	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
erosion, flooding, subsidence and slides	• 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.	• Circular No. 22/2010/TT-BXD: Regulation on construction safety • QCVN 08:2008/BTNMT – National technical regulation on surface water quality		
9. Traffic management	• Before construction, carry out consultations with local government and community and with traffic police. • Set up traffic and maintain instruction signs and warnings to secure safety for people and means of transport during construction. • 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. • 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	• 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
	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			
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.	• 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
	• 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.			
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:	• Decree No. 73/2010/ND-CP on administrative penalization of violations against security and social affairs • 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

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	+ 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.			
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	• 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
	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			
13. 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		Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	in the environmental assessment report.			
14. 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. • Project 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 project phase. • Community concerns and requested information are to be monitored as the project 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 project, as well as contact information about the site managers, environmental staff, health and safety staff, telephone	• 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
	numbers and other contact information so that affected people could have a channel to voice their concerns and suggestions.			
15. Mitigation measures for limitation of access to street household businesses	• Inform the street household businesses of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 weeks before start of the construction. • Set up construction and traffic warning signs at the construction site. • Provide safe and easy acces to the household businesses putting clean and strong thick wood panels or steel plates over the open ditches. • Do not gather materials and wastes within 20m from household businesses and shops. • Do not use machines generating loud noise and high vibration levels near the businesses. • Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. • Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. • Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. • Cleaning up construction areas at the end of the day, especially construction areas in front of business shops. • Providing night lighting system with luminously painted fence and night lamp. • Manage the worker force to any avoid the conflict with the local people and traders. • Compensate goods, products damaged by construction activities of the subproject. • Immediately address any issue/problem caused by the construction activities and raised by the local household traders.	• Decree No. 73/2010/ND-CP on administrative penalization of violations against security and social affairs	Contractor	PMU, CSC, IEMC

The details on the DMMP (Embankment for Nghe lake, T1 cannal and Bach Dang river):

- The contractors are requested to prepare a specific dredging material management plan (DMMP) and submit the same to the Supervision Consultant for approval before starting the work. The dredging plan will indicate volumes, physical-chemical-biological properties of dredged material, dredging procedures, temporary gathering of dredged materials, control of polluting material during temporary gathering and transportation, pollution control, and risks at disposal sites. The detailed guidelines on DMMP are provided in Annex 1.

6.2.2. Site-specific EMP

The following table presents site-specific impacts and mitigation measures that are not fully addressed through the application of ECOPs. This may be because the impact is not a typical one and is not included in the ECOPs, because the severity of the impact goes beyond the scope of the mitigation measures in the ECOPs, or because simply of the very specific nature of the mitigation measure that is needed.

Table 6.2: Site-specific impacts and mitigation measures

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
1	**Sub-component 1.1: Drainage and flood prevention**			
Preparation phase				
UXO clearance	- The subproject owner (the subproject PMU) will sign a contract with the military civil engineering agency or Hai Duong Provincial Military Base for UXO detection and clearance at the construction sites. UXO clearance will be executed right after the completion of site compensation and before the implementation of demolition and ground leveling. The estimated cost is approximately 50 million VND/ha. No construction activity will be allowed until the UXO clearance is completed.	- The military civil engineering agency or Hai Duong Provincial Military	- PMU	- City Fund
- Construction phase				
Localized flooding - Residents along the Nguyen Luong Bang and Thanh Binh road - Residents in Thanh Binh and Viet Hoa wards	- PMU will ensure that detailed design will consider adequate temporary drainage to avoid potential flooding during construction	- Detailed Design Consultant (DDC)	- PMU	- IM: Construction contract conditions - - Fund: IBRD
	- The contractors must apply the specific construction methods, and flood prevention and control alternatives during construction period or the flow diversion alternatives to ensure proper drainage in that area - The contractors must set up temporary drainage system at the construction site and ensure that it is cleared of mud and other obstructions - Have a standby pumps for rapid drainage in case of heavy rain or extreme weather events	- Contractor	- PMU	- IM: Construction contract conditions - - Fund: IBRD
Transport hinderance and impacts on business activities - Local peopel and local business along the Nguyen Luong Bang and Thanh Binh road	- Ensure that the contract requires the contractor, before commencing work, to provides a construction plan with a detailed heath, safety, environment and traffic management plan - Inform local residents in advanced (at least 07 days) about construction and work schedules, interruption of services, traffic routes. - Put and maintain bulletin boards at the construction site, containing	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
- Residents in Thanh Binh and Viet Hoa wards	the following information: full name and phone number of the Contractor, Site Manager, Supervision Consultants and Subproject Owner, duration and scope of work. - Construction is carried out in a sequencing manner, section by section in a short period of time. Avoid the simultaneous construction and delay all over the construction activities - Contractors should provide lighting at a construction site at night; security guard staff at construction sites to regulate vehicles go out and in the construction site; - Put the road construction warning signs at the site all the time. - Avoiding the waste/material transportation during rush hours; - Construction by night time is not allowed - Limit the construction area; the construction activities are only taken in the site boundary - Assign staff to guide the traffic during transportation, unloading, and loading			
Impact on Physical Cultural Resources (PCRs) and sensitive receptors Hai Duong Medical College (70 m from Nguyen Luong Bang road); Hai Duong Medi-Tech Universtiy Hospital (Adjoining Nguyen Luong Bang road) and Hai Duong Tuberculosis and Lung Disease Hospital (adjoining Thanh Binh road)	***Impact on schools:*** - Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction - Construction area to be marked with warning signs to prevent pupils and unauthorized people from entering. - Teachers to be informed of construction operations to keep pupils off the site during their break time. - Prohibit use of construction methods that cause noise during school learning hours. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and	- Contractor	- PMU, CSC, IEMC	Fund: BRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	wastes when children go to and leave the school. - Do not load construction materials within 20m from school and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at end of the working day. - Immediately address any issue/problem caused by the construction activities and raised by the schools ***Impact on hospitals :*** - Inform the hospital management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction - Construction area to be marked with warning signs to prevent and unauthorized people from entering. - Prohibit use of construction methods that cause noise at night - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes when doctors, nurses and patients go to and leave the hopital. - Do not load construction materials within 20m from hospital and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at end of the working day. - Immediately address any issue/problem caused by the construction activities and raised by the hospital			
Operation phase				
Mitigation Measures for Risk of local flooding due to the poor operation and maintenance	To minimize impacts by the status of blockage of drainage system due to inadequate maintenance during operation phase of Thanh Binh and Nguyen Luong Bang road; the O&M units will be implemented mitigation measures follow:	- Hai Duong URENCO	- Hai Duong'PPC	- City operations and maintenance plan, City Fund

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	- The management of storm water drainage along the roads should be focused and examined regularly to detect the congested drainage sewer sections and carry out dredging. - Conduct periodic planning decentralization and dredging sewer sections and manholes in order to minimize the flow congestion (every 6 months). Control disposal of sludge: Similar to the construction phase, those who manage the water drainage systems would have contracts with relevant authorities of sludge dredging from the sewer sections and manholes and then transport to the landfill by specialized tank trucks to avoid odor emission and spillage during transportation.			
2	**Sub-component 1.2: To rehabilitate the rain water drainage system in the north of the railway**			
Preparation phase				
UXO clearance	- As mentioned in Sub-Component 1	- The military civil engineering agency or Hai Duong Provincial Military	- PMU	- City Fund
Lan acquisition and resettlement	- The resettlement consultant, technical consultant and PMU have worked together to analyze the alternative options and select the most suitable design based on the principle of (i) minimizing the resettlement due to land acquisition and (ii) mitigating impacts of land acquisition and resettlement.	- Detailed Design Consultant	- PMU	- City Fund
	- Land acquisition and resettlement will be compliance with the approved Resettlement Policy Framework (RPF), which was prepared in order to establish the resettlement principles, eligibility requirements for compensation, valuation methods, describe the legal and institutional framework, organizational arrangements, funding mechanisms, and community consultation and participation, and grievance redress mechanism to be applied to the project during the project implementation. Resettlement Action Plan (RAP) will be prepared in compliance with the approval RPF and submitted to the World Bank for approval before construction activities will be started.	- Center of Municipal Land Fund Management and Development	- PMU, Ward People's Committee, Hai Duong'PC	- City Fund

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	- The RPF has been prepared in compliance with the World Bank's Operational Policy on Involuntary Resettlement (OP 4,12) and the Vietnam's laws and regulations. The RPF will be applied to all components of the CTUDR Project that result in involuntary resettlement, regardless of the finance source.			
Construction phase				
Local flooding - Residents living around Nghe lake, - Residents in Cam Thuong, Binh Han and Viet Hoa wards	- PMU will ensure that detailed design will consider adequate the rain water temporary drainage to avoid potential flooding during construction	- Detailed Design Consultant (DDC)	- PMU	- IM: Construction contract conditions - Fund: IBRD
	- The Contractors must apply the specific construction methods, and flood prevention and control alternatives during construction period or the flow diverson alternatives to ensure the drainage in the location. - Set up a temporary sewers to ensure drainage at the construction site. - Arranging the standby pumps for rapid drainage in case of heavy rain or extreme weather incidents.	- Contractor	- PMU	- IM: Construction contract conditions - Fund: IBRD
Odors from dredging process, and nuisance and leakage during the transportation of 67,531m^3 sediments from Nghe lake - People living along Nghe lake - Residents in Cam Thuong, Binh Han and Viet Hoa wards	***Management of sediments generated during dredging process: 67,531 m^3 sediments from Nghe lake*** - The Dredged Materials Management Plan (DMMPs) for the dredging Nghe regular lake has been prepared. Overall, excavated materials will be disposed at Sapharie domestic waste treatment plant or being used for agricultural or tree planting purpose based on actual needs of the local people. The DMMP is described in details in chapter 6 – Environmental and Social Management Plan and and Annex 1.	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD
	- Ensure that detailed design of canal dredging will include the update of DMMP with additional analysis of sediment quality, detailed information on the amount of generated sediment, requirements on contractor's dredging method, transportation and disposal that are appropriate and cost-effective. The updated DMMPs will be incorporated into the related bidding documents and contracts	- Detailed Design Consultant (DDC)	- PMU	- IM: Construction contract conditions - Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	- Prior to construction, the contractors shall have a specific DMMP based on the updated DMMP. The contractor's DMMPs shall be submit by Construction Supervision Consultant for approval before starting the work. The dredging plan will indicate volumes, physical-chemical-biological properties of dredged material, dredging procedures, temporary gathering of dredged materials, and control of polluting material during temporary gathering and transportation, pollution control, and risks at disposal sites.	- Contractor	- PMU, CSC, IEMC	Fund: IBRD
	- Manage to ensure sediments will be disposed appropriately according to the approved DMMP.	- Contractor	- PMU, CSC, IEMC	- Fund: BRD
	To control impacts by odors from dredging process: - Sediments materials will be collected along the work sites and covered by the technical fabric to limit slurry leaking into the soil, and transported for disposal within the day. The management plan on dredged materials will be prepared to instruct the contractors to manage the waste source. - Uncontrolled disposal of the dredged sludge is prohibited. The waste source must be managed properly under the supervision of PMU. - In order to limit the impacts of odor of the dredged sludges, the workers shall be equipped with the masks, boots and gloves when working in/exposing to these waste sources. - Spraying EM (Effective Microorganisms) every day. The deodorants can eliminate malodors from H_2S, CH_4, etc. - Dredged materials will be collected, transported and treated by contracts in the Sapharin waste treatment plant (landfill site). Transportation of the dredged sludge must meet the environmental protection requirements and avoid slurry leakage; the sludge carrying trunks must be covered closely and not overloaded as permitted.	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD
Impact on PCRs (Han pagoda, cemetary)	- Inform Han Pagoda/cemetary of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and	- Contractor	- PMU, CSC,	- Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	construction schedule at least 01 month before start of the construction. - The contractor shall coordinate with local authorities (leaders of local wards or communes) for agreed schedules of construction activities at sensitive times (e.g., religious festival days). Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. - Pile driving activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management. - Environmental training for the workers includes codes of conducts when working in public areas and sensitive receptors such as pagodas. - The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to local people and goers to pagoda. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the pagodas. - Truck drivers shall restrict horning in areas close to the pagoda area - Immediately address any issue/problem caused by the construction activities and raised by the pagodas.		IEMC	
Vibration impacts and risk on infrastructure collapse to Han Pagoda	- The contractor should provide evidences proving all equipment and machineries used in the project have been tested and complied with the current Vietnamese Regulations on Vibration from construction activities as specified in the QCVN27:2010/BTNMT; - The construction method shall include the measures to protect the foundation of the fence/gate, of the Han pagoda, such as using supporting pillars or steel frame to prevent the risk on infrastructure collapse/damage. - The contractor should take photos at the initial sate of the construction sitel. In case damages happen, the contractor should take full responsibility in compensating or reconstructing the broken facilities as agreed with the school.	- Contractor	- PMU, CSC, IEMC	- Fund:IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
Operation phase				
Measures to prevent embankment subsidence risk during operation of Nghe regular lake	- To avoid risk on embankment cracking and subsidence, in detailed design should be implemented hydrology and geological surveys to ensure sustainable and stable designs	- DDC	- PMU	- Fund: BRD
	- City shall provide O &M Plan as well as budget source should be approved and arranged by the City. - Ensure the city's operations and maintenance plan, and related budget, includes the work and resources required to maintain the embankment periodically - Closely monitor the construction of other infrastructures within the area that potentially affect the embankment structures	- Hai Duong URENCO	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund
Measures for the status of direct waste disposal into the Nghe regular lake	- During the O&M, to control risks of pollution and flow stagnation due to disposal of waste from households living along the canals, the O&M unit will be implemented mitigation measures follow: - Cooperating with the local government to disseminate information on hygiene practices to the people, and prohibiting to release wastes into the canals; PMU and DONRE should be in collaboration to impose much more serious penalty to polluter - Properly arranging the waste baskets along the canal and launching programs of increasing awareness of the community toward environmental protection; - Carrying out periodical dredging and clearing works of the canals at least 6 months/time especially before the wet season; - Signing contracts with the responsible agencies on collecting, transporting and treating dredged sludge.	- Hai Duong URENCO	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund
Mitigation Measures for Risk of local flooding due to the poor operation and maintenance	- Cooperating with the local authorities to disseminate information on hygiene practices to the people, and prohibiting to release wastes into the drainage systems - Carrying out periodical clearing works of the drainage systems. - Sweeping and cleansing pavements must include clearing the rubbish and obstructing objects on the flow/sewer inlets/heads;	- Hai Duong URENCO	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
Mitigation Measures Risks from the Open Channel System:	- Cooperating with the local authorities to disseminate information on hygiene practices to the people, and prohibiting to release wastes into the drainage systems - Sweeping and cleansing pavements must include clearing the rubbish and obstructing objects on the flow/sewer inlets/heads;	- Hai Duong URENCO	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund
3	**Sub-component 1.3: T1 canal embankment and Lo Cuong Pumping station**			
Peparation phase				
UXO clearance	- As mentioned in Sub-Component 1	- The military civil engineering agency or Hai Duong Provincial Military	- PMU	- City Fund
Lan acquisition and resettlement,	- As mentioned in Sub-Component 2	- Detailed Design Consultant	- PMU	- City Fund
	- As mentioned in Sub-Component 2	- Center of Municipal Land Fund Management and Development	- PMU, Ward People's Committee, Hai Duong'PC -	- City Fund
Construction phase				
Impact on on aquacultural production of T1 canal during dry dredging process	- The dredging operation is conducted only during the dry season; - Create sedimentation traps and maintain them periodically to ensure that most solids in surface runoff are retained in the traps before entering the existing drains or water sources surrounding the sites; - Leachate from sediments must be first deposited in sedimentation hole/trap before entering the canal. - Strictly prohibit contractors to discharge waste into the canal	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	- Upon forecasted stormy weather, suspend all the construction activities, tidy up the sites, brace and protect the materials and construction machines. - Do not gather construction materials as well as machinery and equipment near the stream. Gathering small quantities of materials, fit with the schedule. Materials must be covered with tarpaulin, avoiding the upwind location, near the canal. - Strictly prevent hazardous waste, waste oils or particularly greasy rags from entering the flow. - In case damages happen, the contractor should take full responsibility in compensating loss.			
Odors from dredging process, and nuisance and leakage during the transportation of 6,400 m^3 sediments from T1 cannal - People living along T1 cannal - Residents in Tu Minh ward	- As the mentioned in sub- component 2	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD
Impacts on Inland Waterway	- Coordinate with the local authority to inform local people on the construction plan prior to construction; - Coordinate with the Department of Inland Waterway to flag the signal system on the inland waterway the transport travel through; - Place warning boards along the construction route, both on land and water surface (arrange the road and waterway traffic guide).	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD
Impact on Aquacultural Production	- Informing the community of the construction schedule at least one week before the construction. - Arrange drainage around the construction sites to ensure no soil erosion and sedimentation to the aquacultural area in Sat river near Lo Cuong pumping station. - Regularly check the aquacultural area to ensure construction spoils and wastes do not block them.	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	- Closely consult with the local community to ensure that suitable solutions to problems are taken and communities concerns related to construction activities are addressed. - In case damages happen, the contractor should take full responsibility in compensating loss.			
Impact on Agricultural Land and Fruit-tree Plantation	- Informing the community of the construction schedule at least one week before the construction. - Arrange drainage around the construction sites to ensure no soil erosion and sedimentation to the Agricultural Land and Fruit-tree Plantation. - Provide alternative water diversion from canals to the locations the local people requested, if they are affected. - Regularly check the affected fish ponds to ensure construction spoils and wastes do not block them. - Closely consult with the local community to ensure that suitable solutions to problems are taken and communities concerns related to construction activities are addressed. - In case damages happen, the contractor should take full responsibility in compensating loss.	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD
Risks on soil erosion, embankment subsidence, house cracking during embankment	- Ensure that the detailed design for the embankment includes hydrological and geological surveys to ensure sustainability and stability of the embankment; - Ensure that the detailed design and contractor's construction method take into account the risk on local house cracking	- Detailed Design Consultant	- PMU	- City Fund
	- Before dredging, reinforcement of banks will be conducted. This construction method must be proposed and submitted to the authorities concerned for approval by the construction contractors. - Ensure that land acquisition and house relocation at the site boundary is completed piror to commencing construction workUse construction method to reduce vibration for construction activities of embankment i.e. pipe jacking instead of pile driving; closely monitoring the vibration level; - Construction of side slope is made in accordance with the design	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	- Do not carry out dredging works in rainy season. - Do not place heavy machineries and transportation vehicles near the canals banks. Inspection and supervision on land subsidence risks must be taken regularly in order to prepare the appropriate reinforcement plans.			
Impacts on the PCRs: *Lo Cuong temple (about 30m from Lo Cuong pumping station and T1 canal);* **Impact on sensitive receptors: T***hanh Dong university (about 300m from T1 canal); the medical station in Tu Minh ward (about 150 m from T1 canal)*	**Impacts on Lo Cuong Temple:** - Inform Lo Cuong Temple of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - The contractor shall coordinate with local authorities (leaders of local wards or communes) for agreed schedules of construction activities at sensitive times (e.g., religious festival days). Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. - Pile driving activities will not be carried out before 7 am or after 6 pm, or at days and hours advised by the local management. - Environmental training for the workers includes codes of conducts when working in public areas and sensitive receptors such as pagodas. - The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to local people and goers to pagoda. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the pagodas. - Truck drivers shall restrict horning in areas close to the pagoda area - Immediately address any issue/problem caused by the construction activities and raised by the pagodas.	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD
	- **Impacts on school** - As the mentioned in sub- component 1	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	- **Impacts on medical station:** - As the mentioned in sub- component 1	- Contractor	- PMU, CSC, IEMC	Fund: IBRD
- Operation phase				
Measures the status of direct waste disposal into the T1 cannal	- As the mentioned under the embankment of Nghe regular lake(sub-component 2).	- Hai Duong URENCO	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund
Measures to prevent embankment subsidence risk during operation of T1 cannal	- As the mentioned under the embankment of Nghe regular lake (sub-component 2)	- Hai Duong URENCO	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund
4	**Sub-Component 1.4: Bach Dang River embankment**			
Prepearation phase				
UXO clearance	- As mentioned in Sub-Component 1	- The military civil engineering agency or Hai Duong Provincial Military	- PMU	- City Fund
Lan acquisition and resettlement,	- As mentioned in Sub-Component 2	- Detailed Design Consultant	- PMU	- City Fund
	- As mentioned in Sub-Component 2	- Center of Municipal Land Fund Management and Development	- PMU, Ward People's Committee, Hai Duong'PC	- City Fund
Construction phase				
Impact on Ecosystem and Mollusca Output	- The dredging operation is conducted only during the dry season; - Create sedimentation traps and maintain them periodically to ensure	- Contractor	- PMU, CSC,	Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	that most solids in surface runoff are retained in the traps before entering the existing drains or water sources surrounding the sites; - Leachate from sediments must be first deposited in sedimentation hole/trap before entering the Bach Dang river. - Strictly prohibit contractors to discharge waste into Bach Dang river - Upon forecasted stormy weather, suspend all the construction activities, tidy up the sites, brace and protect the materials and construction machines. - Do not gather construction materials as well as machinery and equipment near the stream. Gathering small quantities of materials, fit with the schedule. Materials must be covered with tarpaulin, avoiding the upwind location, near the canal. - Strictly prevent hazardous waste, waste oils or particularly greasy rags from entering the flow.		IEMC	
Landslide on Bach Dang river banks	- Ensure that the detailed design for the embankment includes hydrological and geological surveys to ensure sustainability and stability of the embankment; - Ensure that the detailed design and contractor's construction method take into account the risk on local house cracking	- Detailed Design Consultant	- PMU	- City Fund
	- Before dredging, reinforcement of banks will be conducted. This construction method must be proposed and submitted to the authorities concerned for approval by the construction contractors. - Ensure that land acquisition and house relocation at the site boundary is completed piror to commencing construction work - Use construction method to reduce vibration for construction activities of embankment i.e. pipe jacking instead of pile driving; closely monitoring the vibration level; - Construction of side slope is made in accordance with the design - Do not carry out dredging works in rainy season. - Do not place heavy machineries and transportation vehicles near the canals banks. Inspection and supervision on land subsidence risks must be taken regularly in order to prepare the appropriate reinforcement plans.	- Contractor	- PMU, CSC, IEMC	Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
Impact on local bridge	- Inform the local people of the construction activities and their potential impacts such as waste, dust, and noise, traffic, especially vibration, risk of cracking on overpass and construction schedule at least 02 weeks before start of the construction. - To use construction method that cause less vibration for construction activities of embankment; - Stabilize and reinforce the canal banks in the vicinity of small bridge over Bach Dang (located about 200 m from the end ternimal of Bach Dang river) prior to the dredging and embankment. - Do not utilize heavy machineries while dredging near the small overpassing bridge. - Place safety signs and provide proper detour instructions on each of the dredging segment that crosses the small bridge - If damage to the bridges happens, a temporary access shall be provided for the local residents. The damage bridges shall be repaired or adequate compensations shall be made upon agreement with affected households and local community.	- Contractor	- PMU, CSC, IEMC	Fund: IBRD
Disruption of business activities	- Inform the street household businesses of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - Set up construction and traffic warning signs at the construction site. - Provide safe and easy acces to the household businesses putting clean and strong thick wood panels or steel plates over the open ditches. - Do not gather materials and wastes within 20m from household businesses and shops. - Do not use machines generating loud noise and high vibration levels near the businesses. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Deploy staff to guide the traffic during construction, transportation, loading and unloading of construction materials and wastes, and to	- Contractor	- PMU, CSC, IEMC	Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	guard high risk operations. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cleaning up construction areas at the end of the day, especially construction areas in front of business shops. - Providing night lighting system with luminously painted fence and night lamp. - Manage the worker force to any avoid the conflict with the local people and traders. - Compensate goods, products damaged by construction activities of the subproject. - Immediately address any issue/problem caused by the construction activities and raised by the local household traders.			
Odors from dredging process, and nuisance and leakage during the transportation of 6,400 m^3 sediments from T1 cannal - People living along T1 cannal	- As the mentioned in sub- component 1	- Contractor	- PMU, CSC, IEMC	Fund: IBRD
Operation phase				
Measures the status of direct waste disposal into the Bach Dang embankment	- As the mentioned under the embankment of Nghe regular lake. (sub-component 2)	- Hai Duong URENCO	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund
Measures to prevent embankment subsidence risk during operation of the Bach Dang embankment	- As the mentioned under the embankment of Nghe regular lake. (sub-component 2)	- Hai Duong URENCO	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund
Sub-component 1.5: Construction of the wastewater collection system in the west of the city				

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
Preperation phase				
UXO clearance	- As mentioned in Sub-Component 1	- The military civil engineering agency or Hai Duong Provincial Military	- PMU	- City Fund
Lan acquisition and resettlement,	- As mentioned in Sub-Component 2	- Detailed Design Consultant	- PMU	- City Fund
	- As mentioned in Sub-Component 2	- Center of Municipal Land Fund Management and Development	- PMU, Ward People's Committee, Hai Duong'PC	- City Fund
Construction phase				
Impact on Ecosystem and Fishery Output	- Create sedimentation traps and maintain them periodically to ensure that most solids in surface runoff are retained in the traps before entering the existing drains or water sources surrounding the sites; - Leachate from sediments must be first deposited in sedimentation hole/trap before entering the Sat river or ponds around WWTP area - Strictly prohibit contractors to discharge waste into Sat river and ponds around WWTP area. - Upon forecasted stormy weather, suspend all the construction activities, tidy up the sites, brace and protect the materials and construction machines. - Do not gather construction materials as well as machinery and equipment near the stream. Gathering small quantities of materials, fit with the schedule. Materials must be covered with tarpaulin, avoiding the upwind location, near the canal. - Strictly prevent hazardous waste, waste oils or particularly greasy rags from entering the flow. - Regularly check the affected fish ponds to ensure construction	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	spoils and wastes do not block them. Closely consult with the local community to ensure that suitable solutions to problems are taken and communities concerns related to construction activities are addressed. In case damages happen, the contractor should take full responsibility in compensating loss.			
Impact on Existing Infrastructure	- In case the project need temporary land acquisition during construction duration, compensation for affected standing crops/trees and income lost during period of temporary acquisition must be paid to PAP. - Compensation Policy for damages of private or public structures occurring during construction execution. - Damaged property will be restored to its former condition or compensated by contractors, immediately when occurred; - Under their contract specifications, the contractors will be required to take extreme care to avoid damaging property during their construction activities. Where damages do occur, the contractor will be required to repair the damage and may also be required to pay compensation to the affected families, groups, communities, or government agencies at the same compensation rates that are applied to all other assets affected by the Project.	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD
Impact on the PCRs: Dong Nien temple (35 m from Booster pumping station No. 5); Co Hoai temple (30 m from Booster pumping station No. 10); Cam Khuc Pagoda (22 m from Booster pumping station No. 22) **Impact on sensitive receptors**:	***Impacts on Dong Nien, Co Hoai temple and Cam Khuc Pagoda*** - Inform Pagodas and Temple of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - The contractor shall coordinate with local authorities (leaders of local wards or communes) for agreed schedules of construction activities at sensitive times (e.g., religious festival days). Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. - Pile driving activities will not be carried out before 7 am or after 6	- Contractor	- PMU, CSC, IEMC	- Fund: IBRD

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
Nhi Chau kindergarten (50 m from Booster pumping station No. 1); Viet Hoa kindergarten (10 m from Booster pumping station No. 5) Tan Binh kindergarten (1 m from Booster pumping station No. 16) Tu Minhkindergarten (20 m from Booster pumping station No. 21) Local market (15 m from Booster pumping station No. 24)	pm, or at days and hours advised by the local management. - Environmental training for the workers includes codes of conducts when working in public areas and sensitive receptors such as pagodas. - The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to local people and goers to pagoda. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the pagodas. - Truck drivers shall restrict horning in areas close to the pagoda area - Immediately address any issue/problem caused by the construction activities and raised by the pagoda and temples - Impacts on kindergartens - As the mentioned in sub- component 1 - Impact on Local market - Limiting to transport materials/wastes passing by Nguyen Du Market at the peak hours (morning: 5-9h; noon: 11-12h; afternoon and evening: 16 - 19h), which does not create any obstacles to the travelling/business activities of the residents. - Spray sufficient water to suppress dust during dry and windy days at least two times a day at road along the market area. - Inform household businesses/market's management unit of the construction and transportation activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02 weeks before start of the construction.			
Operation phase				
Odor control	- The following measures are required to prevent, minimize, and control air emissions and odors during operation: - Domestic waste and sludge generated during the operation of the plant will be safely collected by specialized tank trucks and transported away by Hai Duong URENCO to serve the planting of urban green trees or to be dumped at Sapharin Hai Duong Waste	- Operating Unit (to be selected by Hai Duong CPC when the project is brought to use)	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	Treatment Plant). This will reduce bad odors generated from sludge; - There will be plans to periodically test and monitor air concentrations to obtain proper evaluation and control operation processes in a logical manner.			
Sludge	- Practical experience shows that, sludge generated from domestic wastewater treatment plants can be used for production of organic fertilizer after it is dewatered because it does not contain heavy metals, industrial waste and high organic content. Therefore, it can be used as fertilizer for plants. This use is only allowable if the sludge content meets QCVN 03: 2015/BTNMT: National technical regulation on heavy metals content in soil. When the dredged sludge contains many heavy metals, Employer and operator of the facility will contract with the hazardous waste treatment (possibly Sapharin Hai Duong Waste Treatment Plant) to handle the sludge pieces. - Hai Duong URENCO will be employed to periodically dredge sludge from sewer systems and transport this sludge for disposal at landfill. Transportation will be carried out by specialized tank trucks to avoid odor emission and sludge spillage along the route	- Operating Unit (to be selected by Hai Duong CPC when the project is brought to use)	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund
Domestic Wastewater	- Domestic wastewater from the WWTP will be pretreated through 3 compartments of septic tanks before being discharged into combined sewers and will be directed to the treatment area.	- Operating Unit (to be selected by Hai Duong CPC when the project is brought to use)	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund
Measures to minimize impact on receiving water	- An online monitoring system is to be installed at the WWTP for controlling the wastewater inflow, quality of the influent and effluent at the WWTP; - The quality of sample effluent from the WWTP must be analyzed once every 3 months; - Treatment facilities are to be periodically checked and maintained to ensure highest performance of the system; - Troubleshooting plans must be prepared to respond promptly to incidents in due time (standby generators, standby pumps, discharge incident) in order not to disrupt the operation of the plant;	- Operating Unit (to be selected by Hai Duong CPC when the project is brought to use)	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund

Sensitive receptors and Site-Specific impacts	Site-specific mitigation measures	Responsibility	Monitored	Budget & Implementing Mechanism (IM)
	- Based on an assessment of risks to human health and the environment, consider re-use of treated effluent, especially in areas with limited raw water supplies. Treated wastewater quality for land application or other uses should be consistent with the relevant public health-based guidance from the World Health Organization (WHO) and applicable national requirements			
Hazardous Waste	- The subproject owner will register as the owner of hazardous waste according to Circular No. 36/2015/TT-BTNMT dated 30 June 2015 on hazardous waste management; - Containers of hazardous waste are to be placed on flat floors without tilting, tumbling, and must be free from stormwater infiltration. Collected hazardous waste will be stored in containers/houses and labeled as currently stipulated. Packaging materials for chemicals will be returned to the suppliers; - Once every 2-3 months, the WWTP will have to employ a local contractor tasked with handing hazardous waste to collect, transport and handle such waste; - Empty chlorine containers are to be returned to manufacturers	- Operating Unit (to be selected by Hai Duong CPC when the project is brought to use)	- Hai Duong 'PPC	- City operations and maintenance plan, City Fund

6.2.3. Management of Impacts on Physical Cultural Resources

Based on the ESIA study and the preparation of the RAP, non sensitive works, temples, historical sites, and natural conservation areas are affected by land acquisition.

If in the construction phase, specific procedures are to be applied in case of archeological artifact finds. The Figure 6.1 below identifies steps to be taken. The PMU will be responsible for the overall coordination and reporting. The chance find procedures will be included in all construction contracts and key staff and contractors will be trained on how to implement them.

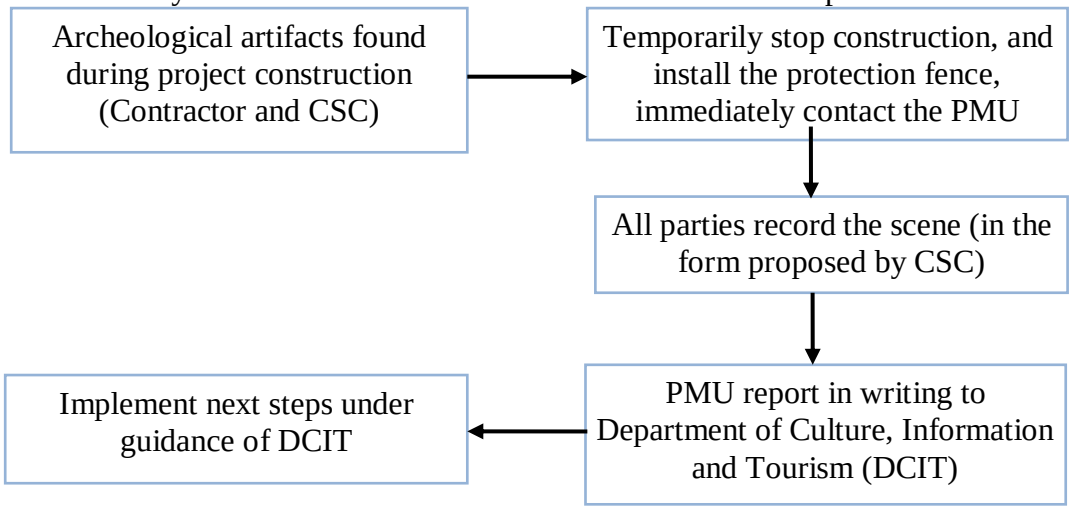


Figure 6.1: Chance-finding procedure in case of archeological artifacts found during the project construction

6.2.4.Emergency Procedures

During construction period, if there are environmental emergency or labor accidents, the Contractors have to make a report to describe in details the incidents and taken actions. The reports on the incidents have to be submitted to the Construction Supervision Consultants (CSC) and PMU for review and archive. The reports also have to be submitted to the concerned agencies if required. Please find below some risk response action plans:

6.2.4.1.Vehicle Accidents

Vehicle accidents may include, but are not limited to:

- Vehicle roll-over; and
- Vehicle crash with another vehicle, structure or with a person (worker or person from the local community).

Procedure:

- Stop work immediately;
- Turn off the vehicle, if possible;
- Help passengers of the vehicle(s) exit the vehicle and move to a safe place, if possible;
- If there is an injury, follow the procedure for medical emergencies (see below); and
- If there is a fuel/chemical spill, follow the procedure for spill emergency (see below).

6.2.4.2. Electrical faults/accidents

It is not safe to carry out the works within a 10m radius area of electrical cables, electrical accidents may happen as the result of:

- Collision with power cables and poles;
- Collapse of cable poles; and
- Hitting underground cables.

Procedure:

When an electrical accidents occurs:

- Stop work immediately;
- Isolate the power source, if possible and safe to do so (e.g. using a non-conductive rod to detach cables);
- If there is an injury/medical need, follow the procedure for medical emergencies (see below); and
- HSE Manager of the Contractor will inform EVN for further action (e.g. stopping power and conduct repairs), coordinate the authority inspection and facilitate the communication with authorities/media, if required.

Fire

Flammable hazardous materials and wastes will be present on site (including fuels, oils, etc.). A fire can also be caused by using ignition sources nearby (e.g. smoking or cooking by workers and residents) or engine incidents.

All the bulldozers, excavators, HW and hazardous materials storage areas, and the site office must be equipped with portable (?) 2 kg fire extinguisher in each location (the type depends on the immediate fire risk). The fire extinguishers must be in good working condition. The Contractors' Supervisor – Vehicles and Devices shall perform monthly checks and replace as needed – tags shall be kept on the extinguishers which indicate their validity.

Procedure:

- Upon identification of a fire incident, try to suppress the fire if it is deemed possible and safe to do so using the available suppression equipment);
- If it is not possible to do so, move to a safe location (up wind and sufficient distance) and report the fire to the fire brigade stating your name, location, the status of the fire;
- Report the fire to the Contractors' General Manager; and
- The Contractors' General Manager will inform all workers and on-site visitors and ensure that they are all accounted for and in safe locations. They shall also inform the PMU HSE Manager, who shall inform the applicable government department and any households on or off site who may be in danger and advice them to evacuate.

Chemical/Fuel Spill

A spill of chemical/fuel has the potential to cause soil and underground water contamination, if not controlled and cleaned up timely and properly. Chemical/fuel spills include, but are not limited to, the following:

- Fuel spill during refueling;

- Fuel/oil/grease leaks during vehicle parking or operating; and
- Breaking of fuel tanks on vehicles.

Spill response facilities: A spill kit shall be provided on each heavy equipment (bulldozers and excavators), in the HW and hazardous materials storage areas, and in any designated fueling locations. A spill kit includes a drip tray, absorbent materials, and impermeable bags to collect contaminated soil and used absorbent materials, and a small spade used for collecting contaminated soil.

Procedure:

- When there is a spill, immediately use the absorbent materials to absorb the spilled materials and locate the drip tray to collect the spilled flow (if the spill continues);
- Collect used absorbent materials into an impermeable bag;
- Use the spade to collect the contaminated soil into the impermeable bag; note that there should be no contaminated soil left (stained soil must be collected to the full horizontal and vertical depth of the impact);
- Transfer the filled impermeable bag to the HW Storage Area for storage;
- If the spill is larger than one spill kit or person can handle, request another worker to support (e.g. to bring more spill kits);
- Use work gloves, safety glasses, long sleeved tops and trousers during the above response process and minimize direct contact with the spilled fuel/oil; and
- At and around the location of release, samples shall be taken to confirm whether any contaminated soil/underground water remains. The number of samples will depend on the scale of the release and the estimated impacted area. The parameters to be analyzed will depend on the substance released. Depths where samples are taken should be at the ground surface and immediately above the underground water table. These should be identified in a sampling plan prepared by the HSE Management and Monitoring Office in consultation with appropriately qualified technical staff. Response to any remaining contamination should be defined accordingly.

Medical Emergency

A medical emergency is a situation in which, due to an acute illness or injury, there is an immediate risk to a person's life or long-term health. Medical emergencies include, but are not limited to, the following:

- Injuries from vehicle accidents;
- Wildlife attacks, e.g. snake bites or bees attack;
- Heat stress;
- Electrocution; and
- Unexploded-ordnance incidents.

Procedure:

- Report the injury to the First Aider, stating your name, location, nature of emergency and assistance required;
- Where safe to do so, stay in the location until assistance arrives;

The First Aider will co-ordinate first aid response; the First Aider can give first aid as far as they are capable. If further medical attention is required, then the injured shall be transferred to the nearest medical clinic for further treatment.

Within two working days of receiving an occupational accident investigation record and the minutes of the meeting about disclosure of the occupational accident investigation record, the First Aider must prepare statistics of the occurred occupational accidents and records in a Statistic Book with following principles:

- Every occupational accident that has happened to workers must be recorded;
- When a worker suffers from multiple occupational accidents, each accident must be separately recorded;
- Every occupational accident that has happened to workers that cause them to take one day off or more must be recorded.

Adverse Weather

Potential adverse weather events include, but are not limited to: Heavy rain; Strong wind; or Typhoon. The potential for an earthquake, tsunami and heavy flood happening at the site is considered unlikely.

Procedure:

The Contractor General Manager will check the national and local weather forecast each morning prior to work commencing. Should adverse weather be predicted, depending on the severity and timing of the weather expected. If adverse weather is expected to be serious, lengthy and soon (e.g. in the case of a typhoon), the Contractor General Manager shall contact all workers not to come to work. If the weather is less serious and is not expected to last long, the Contractor Supervisor - Workers will cover this situation during the daily toolbox talk, continue to monitor the weather situation throughout the day and issue instructions as necessary to stop work, do their work sites safe, and find a safe sheltering location (either back at the site office, if sufficient time to return, or locally to the active works (in the case of the latter, the worker shall call the Contractor Supervisor – Workers to inform them where and when they are in the sheltering location). If the Contractor Supervisor – Workers do not hear from a worker(s) within 15 minutes of instruction to shelter, the Contractor Supervisor – Workers shall mobilize to the location by car to ensure the safety of the worker(s).

Broken water pipes

The existing water supply pipes on the routes may be broken due to the following reasons:

- During earthwork process for constructing foundation holes, inappropriate identification of the location or the wrong operating actions by the workers, non-compliance with the technical design drawings may cause the collision between the construction equipment and the water supply pipes;
- The affecting force of the construction equipment focuses on one place, while the foundation of the construction area is weak, which creates the break of the water supply pipes;
- Such incidents if occur will create a loss of the huge water volume and an impact on the domestic water demand of the residents who access to this water supply source.

Procedure:

- Immediately turn off the valve/use the availabe facilities, materials in the site to seal the cracks, breaks temporarily;

- Inform immediately the functional agency in charge of the particular water supply pipes for timely repair; Excavate a ditch to lead the water flow to the drainage sewer/canals to limit the water spill out on the surface;
- Advice the residents in vicinity the water reserve alternative during repair, incident recovery time.

Sanitary Effluent Spill

- A spill of sanitary effluent has the potential to cause surface water, soil and underground water contamination and nuisance/health hazard to nearby households, if not controlled and cleaned up timely and properly. Sanitary effluent spills can occur during emptying and transportation of effluent from septic tanks being demolished on site.
- Spill response facilities: A spill kit shall be provided on each septic tank collection truck. A spill kit includes impermeable bags to collect contaminated soil and a small spade used for collecting contaminated soil.

Procedure:

- When there is a spill, immediately stop the flow;
- Use the spade to collect the contaminated soil into the impermeable bag; note that there should be no contaminated soil left (contaminated soil must be collected to the full horizontal and vertical depth of the impact);
- Transfer the filled impermeable bag to the Waste Storage Area for storage;
- If the spill is larger than one spill kit or person can handle, request another worker to support (e.g. to bring more spill kits);
- Use work gloves, safety glasses, long sleeved tops and trousers during the above response process and minimize direct contact with the spilled effluent.

6.3. SOCIAL ACTION PLAN

6.3.1.HIV/AIDS and other sexually transmitted diseases, human trafficking

During project implementation, there will be a large amount of the labor force focusing in the construction sites. According to the experience from the previous similar construction projects, the STI rate in the labor groups will increase if there are no applied prevention measures in order to ensure that the workers are protected against the STD, which include HIV/AIDS. The public health action plan will be set up based on the previous experience of the earlier projects and the public consultation in order to ensure that the works are protected against STI.

In order to mitigate and address the HIV/AIDS related risks and human trafficking, it requires paying a special attention to women. The Project needs to conduct a good communication and dissemination on HIV/AIDS and other risks such as drug abuse and human trafficking. HIV/AIDS programs should include the awareness enhancement campaigns in the construction sites and in the community, peer education development and public monitoring in combination with understanding about safe migration which are implemented and monitored by the communities, PMU and Women's Unions of the project's communes.

6.3.2. Gender action plan

Gender action plan should be developed to ensure the participation of women in all activities of the project and ensure equality for women in getting benefits and access to the project. The Gender Action Plan should ensure the following objectives:

- To ensure the presence of female representative in the community monitoring and management activities:

- At least 30% women are trained in the field of project management.
- At least 50% of women are trained about sensitive issues.
- For community leaders, government officials and consultants involved in the implementation and handing over of the project, the Project Management Unit will take the objective of recruiting 50% female staffs, of which 30% holding decisive position.

- To create jobs for female workers in the project area:

- 15% of unskilled workers to be hired in construction time will be women. 10% of staffs for operation and maintenance of the project will be women.

- To raise public awareness about the activities of the project and to improve the sustainability of the environment.
- Raising awareness of the local leaders and local people on gender;
- Raising awareness of local people including men and women about the positive and negative effects of the project;
- Ensuring the involvement of both women and men in the area in communication activities to mitigate negative impacts of the project;
- Ensuring equal opportunity for both women and men in accessing to and getting benefits from livelihood supporting programs, especially single women, poor women.

6.3.3. Communication and community consultation

Community consultation meetings need to be organized through the implementation of the project, from preparation to construction and after handing over and operation of the project, ensuring (i) to provide people with full information on the project; (ii) community consultation on technical solutions in all item of project; (iii) active participation of community in activities of the project; (iv) participatory monitoring and evaluation of the community.

Information in the public consultation will be provided free of charge, publicly and in advance; people's demands, wishes and contribution ideas will also be recorded in these consultation meetings.

6.3.4. Temporary impact mitigation measures

The implemented activities include:

- Increase the community awareness on safe transport and prevention of social evils during construction period;
- Incorporate in the Contracts with the Contractors the measures for transporting the materials and sludge wastes in conformity with the regulations on the loads of the vehicles taking the materials and wastes. When there are damages in the local infrastructures due to the transportation, the contractors have to recover the affected infrastructures, reinstate the original site as before carrying out the project.

Table 6.3: Social impact mitigation measures

Negative impacts	Mitigation measures	Implementing agencies

Negative impacts	Mitigation measures	Implementing agencies
Impacts on transport and incremental social evils	Public awareness improvement on safe transport and prevention of social evils for the local citizens	PMU should coordinate closely with the various level authorities in carry out the communication strategy. Based on the available communication system in the communes, to take necessary action on dissemination of information on Project's activities to the households.
Effects to the infrastructures	Contractors' compliance with the rules on infrastructure recovery	PMU should request the contractors to follow the regulations on loads and environment and sanitation measures in transporting materials as well as regulations stipulated for cases of creating effects on roads.

6.4. ENVIRONMENT MONITORING PROGRAM

6.4.1. Objective and Approach

Main objective of the Environment Monitoring program is to ensure that (a) the potential negative impacts of the project are minimized; (b) the ESMP is effectively implemented; and (c) the ESMP is adequate to mitigate the potential negative impacts. Given that monitoring the implementation of the RP will be conducted separately, the environmental monitoring program will comprise (a) monitoring the safeguard performance of the contractor during site clearance and construction, (b) environmental quality monitoring, (c) monitoring effectiveness of the ESMP.

6.4.2. Monitoring of Contractor's Safeguard Performance

Three levels of safeguard monitoring will be implemented: routine monitoring, periodic monitoring, and community monitoring as follows:

Routine monitoring: The routine monitoring will be made by the Construction Supervision Consultant (CSC) as assigned by PMU. The CSC will include the monitoring results in the project progress reports.

Periodical monitoring (every six months): As part of the overall monitoring of the ESMP, the ESU assisted by the Independent Environmental Monitoring Consultant (IEMC) will also monitor the contractors' performance every 6 months and the results will be reported to the PMU and the WB.

Community monitoring: Monitoring by local communities will be conducted following the Government practices with the technical and management support from the PMU.

6.4.3. Environmental Quality Monitoring

To ensure an acceptable level of environmental quality, monitoring of dust, noise, vibration, air quality, and water quality will be made at project specific locations that are likely to be significantly affected by the construction activities, or requested by local authorities and communities for specific purposes. ESU/IEMC will be responsible for the monitoring of the program.

Below is a list of the key issues and scope of monitoring that will be considered in the implementation of the monitoring program:

Implementation of the Dredge Material Management Plan (DMMP) for all sludge and similar material excavated from the project work sites: Amount, level of heavy metals, locations and performance at disposal sites, and impacts on local residents will be monitored. Outline DMMPs will be prepared during detailed design, and will be used as the basis for contractors' dredged materials management plans.

General Construction Impacts: To include local flooding; traffic management especially in residential areas; air, noise, and dust levels in residential areas; and water quality upstream and downstream of construction sites, with specific attention paod and impact on local residents;

Others: As agreed with local agencies and communities during the preparation of the monitoring program.

Table 6.4 provide general guidance on the monitoring program considering that the activities will be carried out before construction (project baseline environment), during construction (assumed 5 years), and during the first 2 years of operation. Detailed monitoring programs will be prepared during the detailed design stage. An estimated cost for monitoring is incorporated into the ESMP cost (Section 6.4.5). Many of these measurements are required by Vietnamese regulations and would need to be done even if not directly related to expected project impacts.

Table 6.4: Location, parameters and frequency of monitoring

No	Monitored items	Preparation and construction phase
Preparation phase and Construction phase		
I	**Monitoring of air quality**	
1.1	Monitoring parameters	noise, TSP, CO, NO_2, SO_2, HC, H_2S, microclimate
	Monitoring frequency	Preparation phase: one obtained for determining base conditions Construction phase: measurements taken every three-months
	Applied Regulation	QCVN 05 :2013/BTNMT, QCVN 06:2009/BTNMT
1.2	Monitoring positions	KK1: Nguyen Luong Bang – Vu Huu intersection KK2: Nguyen Luog Bang – Thanh Binh intersection KK3: End of Thanh Binh road (adjacent to Sat river) KK4: Nghe lake (near the residential area) KK5: Dien Bien Phu – NH5 intersection KK6: Truong Han Sieu –NH5 intersection KK7: Dinh Van Ta road near Viet A furniture factory KK8: Nguyen Khuyen – Phan Dinh Phung intersection KK9: Start point of T1 canal – Tan Dan road KK10: Vu Manh Hung – Vu Cong Dan intersection KK11: New Lo Cuong pumping station – Lo Cuong village's temple KK12: Tam Giang bridge KK13: Chuong Duong bridge KK14: Area for construction of the WWTP (behind Thanh Dong university) KK15: Dien Bien Phu – Nguyen Thuong Man intersection KK16: Nguyen Van Linh – Ngo Quyen intersection
II	**Surface Water Quality Monitoring**	
2.1	Monitoring parameters	pH, temperatures, salinity, TSS, BOD5, NH4+, Cl-, T-N, T-P, Fe, As, Mn, total oil, coliform
2.2	Monitoring frequency	Preparation phase: oneobtained for determining base conditions Construction phase: measurements taken every three - months
2.3	Applied Regulation	QCVN 08-MT:2015/BTNMT
2.4	Monitoring positions	NM1: the drainage ditch crossing with Dinh Van Ta road NM2: T1 canal - start point of Tan Dan road NM3: T1 canal - start point of Tan Dan road NM4: Sat river – location for construction of Lo Cuong pumping station NM5: Bach Dang river – Tam Giang bridge NM6: Bach Dang river – Chuong Duong bridge NM7: Area for construction of the WWTP NN8: Sat river – tentative discharge location NM9: Sampling location
III	**Soil Quality Monitoring**	
3.1	Monitoring parameters	As, Hg,Cd, Cr, Cu, Pb, Zn

No	Monitored items	Preparation and construction phase
3.2	Monitoring frequency	Preparation phase: oneobtained for determining base conditions Construction phase: measurements taken every 6 months
3.3	Applied Regulation	QCVN 03-MT :2015/BTNMT
3.4	Monitoring positions	D1: Nghe Lake D2: Construction area of Lo Cuong pumping station D3: Construction area of wastewater treatment plant
IV	**Sediment quality Monitoring**	
4.1	Monitoring parameters	As, Hg,Cd, Cr, Cu, Pb, Zn
4.2	Monitoring frequency	Preparation phase: oneobtained for determining base conditions Construction phase: measurements taken every 6 months
4.3	Applied Regulation	QCVN 03-MT :2015/BTNMT
4.4	Monitoring positions	TT1: Nghe Lake TT2: Drainage ditch adjacent to Dinh Van Ta street TT3: T1 canal, Tan Dan road TT4: T1 canal, intersection with Vu Cong Dan road TT5: Bach Dang river –Tam Giang bridge TT6: Bach Dang river–Chuong Duong bridge TT7: Sat river area - the tentative discharge area of the plant
V	**Monitoring of erosion**	**During embankment construction**
VI	**Monitoring of solid waste**	**Monitoring volume of waste generated and sludge dredged**
VII	**Monitoring of hazardous waste**	**Monitoring volume at storage location**
Operation Phase (in the first 2 years)		
I	**Monitoring of Air quality**	
1.1	Monitoring parameters	Noise, vibration TSP dust, CO, SO_2 and NO_2
1.2	Monitoring frequency	Every quarter
1.3	Applied Regulation	QCVN 26:2010/BTNMT, QCVN 27:2010/BTNMT, QCVN 05:2013/BTNMT
1.4	Monitoring positions	KK14: Area for construction of the WWTP (behind Thanh Dong university)- At the right wind direction in the WWTP construction area KK15: Dien Bien Phu – Nguyen Thuong Man intersection- At the end wind direction in the WWTP construction area
II	**Monitoring of Surface Water Quality**	
2.1	Monitoring parameters	pH, T, turbidity, DO, COD, BOD5, TSS, Cu, Zn, Fe, Cd, AS, Pb, oil and grease, coliform
2.2	Monitoring frequency	Once every quarter
2.3	Applied Regulation	QCVN 08-MT:2015/BTNMT
2.4	Monitoring positions	NN7: Area for construction of the WWTP NN8: Sat river – tentative discharge location

No	Monitored items	Preparation and construction phase
III	**Municiple wastewater**	
3.1	Monitoring parameters	pH, TDS, TSS, BOD5, NH4+, NO3-, PO43-, oil and Coliforms
3.2	Monitoring frequency	Once every quarter
3.3	Applied Regulation	Regulation for reference: QCVN 14:2008/BTNMT)
3.4	Monitoring positions	NT1: The WWTP input

6.4.5. Estimated Costs for Environmental Monitoring Program

Table 6.5: Monitoring costs in preparation and construction phase

No.	Content	Unit	Locations	Nunber of Sample	Price	Amount	
					(VNĐ)	(VNĐ)	(USD)
1	**Noise**					**26,376,000**	**1,158.88**
	L_{Aeq}	Sample	16	336	78,500	26,376,000	1,158.88
2	**Vibration**	Sample	16	336	78,500	**26,376,000**	**1,158.88**
3	**Air Quality**					**394,766,400**	**17,344.75**
	TSP	Sample	16	336	58,200	19,555,200	859.19
	CO	Sample	16	336	584,700	196,459,200	8,631.78
	NO_2	Sample	16	336	254,200	85,411,200	3,752.69
	SO_2	Sample	16	336	277,800	93,340,800	4,101.09
4	**Surface water Quality**					**766,546,200**	**33,679.53**
	SS	Sample	9	189	148,800	28,123,200	1,235.64
	COD	Sample	9	189	258,400	48,837,600	2,145.76
	BOD_5	Sample	9	189	218,500	41,296,500	1,814.43
	NH_4+	Sample	9	189	256,700	48,516,300	2,131.65
	NO_2-	Sample	9	189	306,300	57,890,700	2,543.53
	NO_3-	Sample	9	189	226,100	42,732,900	1,877.54
	PO_4^3-	Sample	9	189	243,500	46,021,500	2,022.03
	Cl-	Sample	9	189	252,000	47,628,000	2,092.62
	Fe	Sample	9	189	362,700	68,550,300	3,011.88
	Surfactant	Sample	9	189	842,300	159,194,700	6,994.49
	Oils	Sample	9	189	842,300	159,194,700	6,994.49
	Coliform	Sample	9	189	98,200	18,559,800	815.46
5	**Sediment**					**137,144,700**	**6,025.69**
	As	Sample	7	77	826,700	63,655,900	2,796.83
	Cu, Zn	Sample	7	77	477,200	36,744,400	1,614.43
	Pb, Cd	Sample	7	77	477,200	36,744,400	1,614.43
6	**Soil**					**82,618,800**	**3,630.00**
	As	Sample	3	33	591,600	19,522,800	857.77
	Cu	Sample	3	33	426,500	14,074,500	618.39
	Zn	Sample	3	33	426,500	14,074,500	618.39
	Cd	Sample	3	33	529,500	17,473,500	767.73

No.	Content	Unit	Locations	Nunber of Sample	Price	Amount	
					(VNĐ)	(VNĐ)	(USD)
	Pb	Sample	3	33	529,500	17,473,500	767.73
IEMC total cost						**1,433,828,100**	**62,997.72**
IEMC total cost (rounded)						1,433,828,100	62,998

Table 6.5: Monitoring costs in operation phase

No.	Content	Unit	Location	Nunber of Sample	Price	Amount	
					(VNĐ)	(VNĐ)	(USD)
1	**Noise**					**942,000**	41.55
	L_{Aeq}	Sample	2	12	78,500	942,000	41.55
2	**Vibration**	Sample	2	12	78,500	942,000	41.55
3	**Air**					**14,098,800**	621.91
	TSP	Sample	2	12	58,200	698,400	30.81
	CO	Sample	2	12	584,700	7,016,400	309.50
	NO_2	Sample	2	12	254,200	3,050,400	134.56
	SO_2	Sample	2	12	277,800	3,333,600	147.05
4	**Surface water**					**48,669,600**	2,146.87
	SS	Sample	2	12	148,800	1,785,600	78.76
	COD	Sample	2	12	258,400	3,100,800	136.78
	BOD_5	Sample	2	12	218,500	2,622,000	115.66
	NH_4+	Sample	2	12	256,700	3,080,400	135.88
	NO_2-	Sample	2	12	306,300	3,675,600	162.13
	NO_3-	Sample	2	12	226,100	2,713,200	119.68
	PO_4^3-	Sample	2	12	243,500	2,922,000	128.89
	Cl-	Sample	2	12	252,000	3,024,000	133.39
	Fe	Sample	2	12	362,700	4,352,400	191.99
	Surfactant	Sample	2	12	842,300	10,107,600	445.86
	Oil	Sample	2	12	842,300	10,107,600	445.86
	Coliform	Sample	2	12	98,200	1,178,400	51.98
5	**Waste water**					**13,291,800**	586.32
	pH	Sample	1	6	50,400	302,400	13.34
	TDS	Sample	1	6	148,800	892,800	39.38
	TSS	Sample	1	6	148,800	892,800	39.38
	BOD_5	Sample	1	6	218,500	1,311,000	57.83
	NO_3-	Sample	1	6	306,300	1,837,800	81.07
	NH4+	Sample	1	6	256,700	1,540,200	67.94
	PO_4^3-	Sample	1	6	243,500	1,461,000	64.45
	Oil	Sample	1	6	842,300	5,053,800	222.93
	Coliforms	Sample	1	6	98,200	589,200	25.99
IEMC total cost						**77,002,200**	**3,396.66**
IEMC total cost (rounded)						**77,002,200**	**3,397.00**

In order to ensure the objective, scienctific and real reflection of the positive and negative impacts during project implemenation, the monitoring programs have to be ajdusted at an appropriate time in relevance to the actual site work progress and project schedule. The monitoring stations will be set up based on the monitoring location map which has been made in ESIA report. When the project construction period lasts within 2 years (from the approval time on EIA report), the monitoring data may be used as the primary data.

6.5. SOCIAL MONITORING PROGRAM

The objectives of social monitoring program is to ensure the implementation of impact mitigation measures in order to minimize the negative effects on the living condition of the residents, social and cultural life in the project areas and maintain the sustainable community concurrence on the Project. The program contents are stated as below:

- Monitoring land acquisition and resettlement works
- Monitoring livelihood and income recovery: primary financial supports as per policies; expediting Occupational training programs
- Supervising the implementation of impacts mitigation program on community health and safety
- Supervising mitigation of conflicts of benefits and local economic effects
- Supervising mitigation of gender impacts
- Supervising information release and accountability

The detail contents are presented in Table 6.6:

Table 6.6. Proposed social monitoring program for Hai Duong city subproject

No.	Contents	Targets/Outcomes	Proposed activities	Indicators	Implementing units
1	Land acquisition and resettlement works	- The affected households are able to receive compensation according to WB policy and their income will be recovered; - HHs which have no land will receive one slot in resettlement area.	- Setting up Resettlement policy framework in accordance with the GoV regulations harmonized with WB's policy - Establishing Resettlement Action Plan for land acquisition, compensation, support and implementation of resettlement works - Implementing land acquisition and resettlement works	- Resettlement policy frameworks and plans are established. - Number of the affected HHs, quantity/level of grassroots affection - Number of affected HHs on illegal land assets is clearly identified. - Number of HHs participating in livelihood recovery, occupational training, occupational change.	- PMU - Center of Municipal Land Fund Management and Development - Local authorities - Consultants
2	Monitoring livelihood and income recovery: primary financial supports as per policies; expediting Occupational training programs	- HHs participating in livelihood/income are well assisted.	- Assistances are made following Resettlement Plan Framework - Loan programs - Occupational training	- Number of HHs are assisted as per Resettlement policy framework - Number of HHs has access to loan programs - Number of people/HHs have the occupational trainings	

No.	Contents	Targets/Outcomes	Proposed activities	Indicators	Implementing units
3	Supervising the implementation of impacts mitigation program on community health and safety	- Minimizing risks during construction period, social evils and traffic disturbance.	- Developing action plans on risks and emergency response during construction - Developing social evils mitigation plans during construction - Developing action plans on reducing traffic disturbance during construction	- Number of site shelters/camps fully equipped by first aid services - Number of training courses on occupational safety regulations delivered to the workers - Number of provided labor protective equipment/ total number of laborers - Number of entry restriction sign boards installed in the fences, barriers, warning boards. - Number of local workers (living <5km far from the sites) - Number of site visits by the grassroots health staff - Activities on traffic lane control and divergence	As the above
4	Supervising mitigation of conflicts of benefits and local economic effects	- Minimizing local conflicts of benefits due to free labor migration	Recruiting local labor force instead of recruiting workers from other areas.	- Number of recruited local laborers / total workers of the construction structures	As the above
5	Supervising mitigation of gender impacts	- Assuring maximum participation of the women during the Project implementation as well as the economic role of the women in the HHs	- Mobilizing women to join in community activities of the Project - Supporting to maintain the previous occupation or change to the new ones. - Training on new occupations for women if needed	- Ratios of women participating in Project's community activities - Number of women is assisted to maintain the previous occupations. - Number of women attends in the new occupational training courses.	As the above

No.	Contents	Targets/Outcomes	Proposed activities	Indicators	Implementing units
6	Supervising information release and community consultation.	- Project information is fully, timely disclosed and easy to be accessed by the local citizens. - Improve community participation in the project activities.	- Information disclose is made on wards' radio broadcast, residence information boards, cultural houses, ward People's Committee office areas… - Distribution of leaflets if necessary - Community consultation about technical study in the project area, demand of people in project areas.	- Number of communication sessions on the radio - Number of information stations/wards/work items - Number of distributed leaflets - Number of consultation meetings; -Number of Number of people take part in consultation meetings.	as the above

6.6. ROLE AND RESPONSIBILITIES FOR ESMP IMPLEMENTATION

6.6.1. Implementation Arrangement

The tables and figures below summarize the roles and responsibilities of the key parties and their relationships regarding the implementation of the ESMP.

- Contractors will be responsible for implementing mitigation measures. These measures will be included in bidding documents and their costs are included in construction bid packages;
- CSC will be responsible for monitoring the day-to-day implementation of mitigation measures. Related costsare included in the CSC service contract;
- IEMC will be responsible for overall environmental monitoring which includes support to the PMU in implementing environmentalsupervision and monitoring, and responsible for reporting on the implementation through monitoring reports.

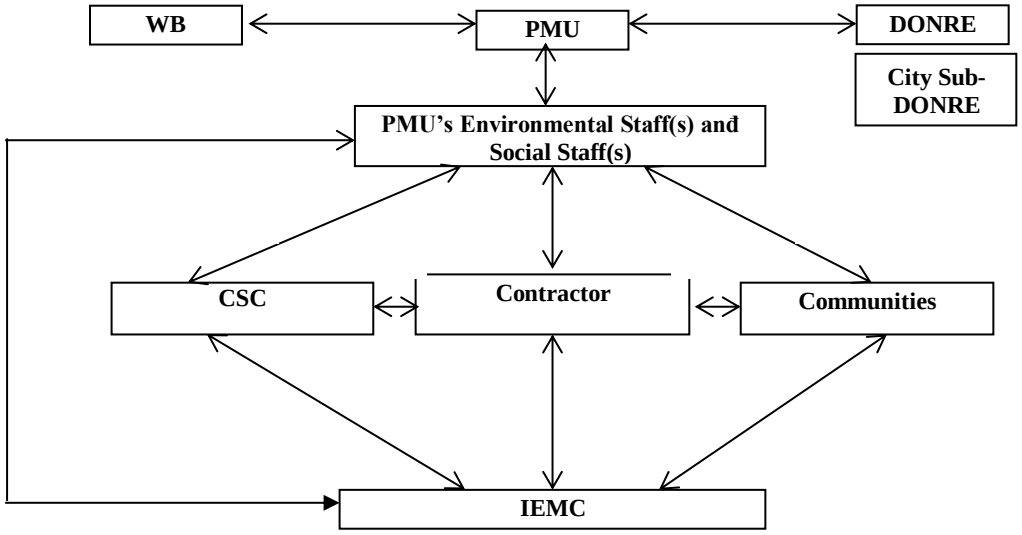


Figure 6.2: Organization chart for ESMP Implementation

Table 6.7: Roles and responsibilities of key parties

Stakeholders	Responsibility
Provincial People's Committee (PPC)	- Overall responsible for environmental and social safeguard implementation and compliance monitoring - Ensure that adequate resources are allocated for safeguard implementation and management
Project Management Unit (PMU) - Project Owner	- The PMU is responsible for monitoring and supervision to ensure that the Project comply with the World Bank Safeguard Policies and Vietnamese legislations: - PMU assign an Environmental Officer (EO) in charge to monitor the implementation and compliance of ESMP and at least a Social and resettlement Officer (EO) to oversee resettlement and compensation issues - Ensure that the mitigation measures proposed in the ESIA are adequately incorporated into relevant project documents such as engineering design, cost estimations, bidding and contractual documents - Ensure that adequate environmental and safety training, monitoring and supervision tasks are included in the Terms of References of the Construction Supervisors - Communicate and coordinate with relevant authorities at central and local levels, with independent monitoring consultants to facilitate public consultation, implementation of mitigation measures and voluntary monitoring - Coordinate with the Construction supervisors to carry out due diligence review of additional sites such as borrow pits and quarries as and when required - Monitor to ensure timely and effective implementation of the ESMP: - Monitor environmental compliance; - Carry out unannounced inspections; - Review periodical reports submitted by the construction supervision consultant (CSC) and IEMC and take follow up actions - Submit periodical safeguard reports to WB and MONRE. - assure all resettlement activities will take place in compliance with this RP. Specifically, PMU will: - Cooperate with PPCs, and relevant local competent agencies to conduct compensation and resettlement. - Organize training and building capacity activities for PPMUs. - Cooperate with PMUs to monitor compensation, resettlement; - Report periodically on resettlement progress to PPC and the WB.
PMU Environmental Staff (ES):	- The EO will advise the PMU leaders on solutions for environmental issues to ensure the compliance with WB's safeguard polices and regulations stipulated by Vietnamese Government. - The EO will coordinate with the CSC team and the contractors to carry out due diligence review of borrow pits, quarries identified during construction phase and decide whether they are eligible for use in the Project - Coordinate with the Environmental Officer of the Construction Supervision team to carry out environmental due diligence review of borrow pits, quarries, disposal sites as well as any other sites required under the Project
PMU Social and Resettlement Officer	- The Social and Resettlement Officer in charge will help with solving social and resettlement issues of the Project, supervising the compliance with RP, participate in investigation and solving complaints related to social issues and land acquisition.
Design consultant	- Incorporate mitigation measures in to engineering design, cost estimates, bidding documents and construction contract,
Construction Supervision Consultant/Engineer (CSC/CSE)	- Provide training for contractor's workers on environment, occupational safety, HIV/Aids training

Stakeholders	Responsibility
	- Arrange for environmental quality monitoring and report preparation for submission to relevant government authorities - Monitor and supervise the Contractors to ensure compliance with ESIA/ESMP - Direct the Contractors to carry out corrective measures when excessive pollution or any non-compliant is detected - Carry out due diligence review of additional sites such as borrow pits and quarries as and when required - When detecting any excessive pollution or any non-compliant contractor, the construction supervision consultant shall propose and direct related contractors to implement additional mitigation or corrective measures to address the issues/impacts to satisfactory level. - Propose the PMU to suspend partially or entirely the construction work if a contractor fails to meet the requirements on safety and environmental protection as agreed or stated in the contract. - Prepare and maintain records on complaints and incidents
Independent Monitoring Consultant	- IEMC will, under the contract scope, provide support to PMU to establish and operate an environmental management system, offers suggestions for adjusting and building capacity for relevant agencies during subproject implementation and monitor the CESMP implementation in both construction and operation phases. IEMC will also be responsible to support PMU to prepare monitoring reports on ESMP implementation. - The IEMC will have extensive knowledge and experience in environmental monitoring and auditing to provide independent, objective and professional advice on the environmental performance of the subproject.
Contractors	- The contractor will assign Enviromental and Social Staff(s) to carry out Enviromental and Social mitigation measures proposed in ESIA/ESMP. - Based on the approved environmental specifications (ECOP) in the bidding and contractual documents, the Contractor is responsible for establishing a Contractor ESMP (CESMP) for each construction site area, submit the plan to PMU and CSC for review and approval before commencement of construction. In addition, it is required that the Contractor get all permissions for construction (traffic control and diversion, excavation, labor safety, etc. before civil works) following current regulations. - The Contractor is required to appoint a competent individual as the contractor‘s on-site Safety and Environment Officer (SEO) who will be responsible for monitoring the contractor‘s compliance with health and safety requirements, the CESMP requirements, and the environmental specifications (ECOP). - Take actions to mitigate all potential negative impacts in line with the objective described in the CESMP. - Actively communicate with local residents and take actions to prevent disturbance during construction. - Ensure that all staff and workers understand the procedure and their tasks in the environmental management program. - Report to the PMU and CSC on any difficulties and their solutions. - Report to local authority and PMU and CSC if environmental accidents occur and coordinate with agencies and keys stakeholders to resolve these issues.
Community	- Community: According to Vietnamese practice, the community has the right and responsibility to routinely monitor environmental performance during construction to ensure that their rights and safety are adequately protected and that the mitigation measures are effectively implemented by contractors and the PMU. If unexpected problems occur, they will report to the CSC and

Stakeholders	Responsibility
	PMU.
City People's Committee (CPC)	- Prepare annual land use plan and submit to competent authorities for review and approval of changed land use plan. - Issue Notice of Land Acquisition and direct Town Board for Compensation and Land Acquisition, - Adjusting or grant a new land use right certificate for the land to be acquired, and for relocated households. - Settle complaints related to land acquisition, compensation, support and resettlement in the district within its jurisdiction. - Approve compensation support and resettlement assessment to be carried out by the City BCLA
City Board for Compensation and Land Acquisition (CBCLA):	- Coordinate with PMU and CPCs to disseminate information and policies on project's policies on compensation and support; - Organize for compensation payment and support to affected people; - Arrange resettlement for relocated households, land acquisition, and handover of acquired land to the construction units; - Lead and coordinate with PMU and CPCs to implement Livelihood Restoration Program; - Assist CPCs to settle complaints concerning land acquisition, compensation and resettlement. - Support CPC in issuance of LURCs for land plot in the resettlement site. - Support the external monitoring consultant for conducting independent resettlement monitoring.
Ward/Commune People's Committee:	- Cooperate with CBCLA in arranging compensation payment, resettlement and livelihood restoration implementation; - Provide documents related to the origin of land use of AHH; confirming the eligibility of affected persons and affected assets; - Assist CPC, CBCLA to organize meetings and public consultations; - Resolve complaints at the ward/commune level - as prescribed by the existing law; Assist authorities to resolve land disputes and complaints.

Evaluation of PMU'sexisting capabilities

Regarding project implementation experience :

So far, Hai Duong city has not implemented any projects financed by WB/ADB or other IFCs, especially urban upgrade projects like DCIDP. At the same time, organizational structures and duties have no unit/agency specialized in management/implementation of projects with capital sources from donors. Therefore, experience and implementation capability is very limited in comparison with the donor's requirements.

Capability of staff:

An assessment of safeguards implementation capacity of existing PMU staff indicates that PMU staffs have limited knowledge on WB safeguard requirements as well as limited knowledge of environment and social issues. Such lack of capacity represents a risk to project implementation of safeguards requirements contained in the ESMP and, as required by the WB policy, is to be addressed through capacity building. Therefore it is proposed to provide capacity building through technical assistance that will support the PMU during the implementation of the safeguards requirements. The technical assistance will provide the necessary technical support the PMU in its work with contractors as well as other entities involved in the implementation of the ESMP.

Equipment :

The PMU will also need to be provided, equipped and updated with new computer software to be used in financial and accounting managementas well as data analyses and consolidation, suiting the accounting standards of both the Vietnamese system and the Donor's system, so that a most suitable and optimal accounting system could be set up to handle finance-accounting management tasks.

6.6.2. Environmental Compliance Framework

(i) Environmental Duties of Hai Duong PMU/Detail Design Consultants

During the preparation of TORs for consulting services and construction bidding documents, Hai Duong 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.

At feasibility study/detail engineering design stage, Hai Duong 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 (pages 174-184 of the ESIA) are considered and incorporated into the engineering design as appropriate.

During construction phase, Hai Duong PMU shall work closely with the supervision consultant to monitor the compliance of contractors and report to relevant authorities. Hai Duong 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.

Hai Duong 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.

(ii) Environmental Duties of the Contractor

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 (CESMP) 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 Staff of the CSC;
- Carry out any corrective actions instructed by the Environmental Staff of the PMU 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 Staffof PMU 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 PMU 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.

(iii) 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 content:

(i) 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.

(ii) A brief document description; Date of issue; Revision status; Distribution list; and preparation personnel details and signoff.

(iii) Applicable laws and regulations associated with the requirements in the subproject ESMP.

(iv) Identification of the contractor licenses, permits and approval associated with the CESMP.

(v) 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 174-185); 2) ECOPs (pages 191-215); 3) site-specific EMP (pages 216-237); 4) social action plan (pages 242-244); 5) the Contractor ESMP to be developed after the contractor is selected and before construction starts; and 6) the Contractor's Dredging Management Plan that the contractor is required to develop (page 271).

(vi) Contractor's plan to carry out self-monitoring of implementation of the CESMP.

(vii) 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.

(viii) 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.

(ix) 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.

(iv) 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 environment officer (SEO). The SEO must be appropriately trained in environmental management and must possess the skills necessary to transfer environmental management knowledge to all personnel involved in the contract. The SEO will be responsible for monitoring

the contractor‘s compliance with the ESMP requirements and the environmental specifications. The duties of the SEO shall include but not 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 PMU and CSC
- Inform the contractor and ES (of PMU and CSC) of environmental issues, submit contractor’s ESMP Implementation Plan to the ES of PMU and CSC, and relevant authorities, if required;
- Keep detailed records of all site activities that may relate to the environment.

(v) Independent Environmental Monitoring Consultant (IEMC)

In order to minimize the environmental impacts during construction phase of the Project, the Project owner shall ensure that environmental quality monitoring requirements are established for the project. An IEMC appointed by PMU shall carry out the monitoring.

- IEMC will be responsible for carrying out environmental sampling, monitoring and marking report during subproject implementation. Environmental monitoring will be report periodically to PMU and World Bank (respectively every 03 months for PMU and every 6 months for WB in construction phase).
- IEMC will also supply specialized assistance to PMU and ES in environmental matters.

(vi) Environmental Supervision during Construction (CSC)

During construction phase, a qualified CSC reporting to the PMU 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 project 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 PMU 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, 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;
- Report contractor's ESMP implementation status to PMU and prepare the environmental supervision statement during the construction phase.

(vii) 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.

(viii) 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.

(ix) Reporting Arrangements

ESMP monitoring and reporting requirements are summarized in table 6.7.

Table 6.8: Regular Reporting Requirements

No.	Report Prepared by	Submitted to	Frequency of Reporting
1	Contractor to the Employer	PMU	Once before construction commences and monthly thereafter
2	Construction Supervision consultant (CSC)	PMU	Weekly and monthly
4	Community Monitoring	PMU	When the community has any complaint about the subproject safeguards implementation
	IEMC	PMU	Every three-month
5	PMU	DONRE	Every six-month
6	PMU	WB	Every six-month

6.7. CAPACITY BUIDLING

The table 6.10 below provides a typical training program on safety policies. Training programs will be developed and implemented by a team of Technical Assistance for the implementation of safety policies for PMU. PMU / IEMC with the help of the Technical Assistance Team will provide training for contractors, CSC and other groups.

- *Trainee groups:* the PMU staff, the ESU department staff, the field engineers (FE), construction supervision consultants (CSC), the building contractors, representatives of relevant stakeholders and local communities in the project area. The contractors take the responsibility for training workers and drivers.

- *Training Schedule:* Training will be given at least one month before performing the first construction contract. Subsequent training sessions can be modified to suit the construction schedule for project components.

- Frequency of training: The basic training programs given in the table below will be provided every 6 months annually, and the contents will be updated and tailored to items to be implemented. Training programs for PMU staff are expected to continue in the first years of the Project. Three-day training for CSC and contractors is also planned to take place twice a year for at least 2 years.

Table 6.10: Advanced training program on environmental monitoring management capacity

I. Subjects	PROJECT MANAGEMENT UNIT
Training course	Environmental monitoring and reporting
Participants	Staff in charge of environmental issues;environmental managers
Training frequency	Immediately after the project becomes valid, but at least one month prior to the first bid package. The next training will be planned on demand.
Duration	Four days
Content	Project-related general environmental management including the request from World Bank, Department of Natural Resources and Environment, in collaboration with competent authorities and concerned stakeholders; Environmental monitoring for the Subproject includes: - Requirements of environmental monitoring; - Monitoring and implementation of mitigation measures; - Community involvement in environmental assessment; - Guiding and monitoring contractors, CSC and community representatives in the implementation of environmental monitoring; - Forms used in environmental monitoring processes; - Reaction and risk control; - Manner of receiving and submit forms; - Other issues to be determined.
Responsibility	With the help of the Technical Assistance Team, the Independent environmental Monitoring Consultant (IEMC) and PMUimplement safety policies.
II. Subjects	**CSC, CONTRACTORS, REPRESENTATIVESOF LOCAL AUTHORITIES (WARDS/COMMUNES), COMMUNITIES**
Training course	Implementation of mitigation measures
Participants	CSC;construction engineers, site construction field manager. staff in charge of environment issues, the contractor; representatives of local authorities; representatives of urban groups
Training frequency	Shortly after awarding contracts to the contractors with updates on demand
Duration	Three-day training for CSC and contractors, and two-day training for others
Content	- Overview of the overall environmental monitoring; - Requirements of environmental monitoring; - The roles and responsibility of the contractors and CSC; - The content and method of environmental monitoring; - Reaction and risk control; - Introducing monitoring forms and instructing on filling out forms and reporting incidents; - Other issues to be determined - Preparing and submitting reports
Responsibility	With the help of technical assistance teams, PMU, the independent environmental monitoring consultant (IEMC) implement safety policies.
III. Subjects	**COMMUNITIES / WORKERS**
Training course	Safety and environmental sanitation

Participants	Representatives of workers (team leaders) working directly for the project components
Training frequency	As appropriate
Duration	One day of presentation and one day of on-site presentation
Content	- Brief presentation on safety issues and overview on the environment; - Key issues requiring the attention of the community and construction workers to mitigating safety risks (land roads, waterways, equipment, machinery, etc.) as well as reducing pollution (dust, exhaust gases, oil spills, waste management, etc.); - Management of safety and environmental sanitation on site and at workers' camps; - Mitigation measures applied on site and camps; - Safety measures for electricity, mechanical engineering, transportation, air pollution; - Methods of dealing with emergency situations; - The rights and responsibilities of environmental monitoring - Environmental monitoring, environmental monitoring form - Measures to mitigate the social impact and monitoring implementationOther issues to be determined
Responsibility	Contractors, PMU with the assistance of IEMC

6.8. TOTAL COSTESTIMATES

The following table provides a cost estimate for the implementation of environmental management plan (ESMP). The cost of ESMP6 implementation will include (i) the costs of implementing mitigation measures by the contractor, (ii) expenses supervised by CSC, (iii) cost of the independent environmental monitoring consultant (IEMC), (iv) 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. The costs of implementing mitigation measures during construction will be a part of the value of construction contracts, while the costs for a site-specific environmental monitoring plan(SEMP) by the construction supervision consultant (CSC) will be provided in construction supervision contracts. The costs of the PMU operations relating to EMP are allocated from the project management budget of the PMU, including safety training programs, and basic allowances to participants in the monitoring programs. After the project has been completed, the costs of environmental monitoring of constructed works will be taken from the operation and maintenance budget of the city.

It should be noted that the involvement of the community in the process of ESMP implementation is completely voluntary participation for the benefit of own community and households. Therefore, communities partaking in monitoring the ESMP will not get paid. However, in order to encourage communityparticipation, it is necessary to allocate costs of materials and instruments for monitoring activities and some remuneration for a small number of members chosen by the public to participate in monitoring activities. As stipulated in the Prime Minister's Decision No. 80/2005 / QD-TTg dated 18 April 2005 promulgating the regulations on investment supervision by the community and Joint Circular guiding the implementation of Decision 80/2005 / QD-TTg, "expenses for the community' s investment monitoring in the commune/ward in are reflected in the

6Excluding costs for RP implementation and independent monitoring the performance of RP/EMP

cost estimates of the Communal Fatherland Front Committee's budget and allocated from the communal/municipal budget; support funds for the dissemination, organization of training courses, guidance, preliminary and final report on investment monitoring by the community at provincial and district levels are balanced in the cost estimates of the Fatherland Front Committee at provincial/district level and allocated from the provincial budget".

The following table provides the estimated costs for environmental quality monitoring and IEMC (in accordance with national practices) for reference purposes. However, final costs will be updated in the detailed design phase.

Table 6.11: Estimated costs of EMP implementation (USD million)

Content	Items of Hai Duong Sub-project (million USD)	Funded by
(a) Mitigation during construction	As a part of the contract	WB
(b) Monitoring safety policies during construction	As a part of the cost for Construction Supervision Consulting (CSC)	WB
(c) PMU's units in charge of environmentalsafety policies	As part of the costs for the PMU	Counterpart funds
(d) Environmental quality monitoring	0.029	WB
(e) Independent environmental monitoring consulting(IEMC)	0.035	WB
(f) Capacity building programs on safeguard policies	0.01	WB

Table 6.12: Estimated costs of IEMC (Exchange rate: 1 USD = 22,750 VND)

No.	Content	Unit	Quantity	Price (VND)	Total (VND)	Total (USD)
1	Specialist salary (I)	person-month	18	20,000,000	360,000,000	15,824
2	Specialist salary (II)	person-month	18	20,000,000	360,000,000	15,824
3	Specialist salary (III)	person-month	18	20,000,000	360,000,000	15,824
4	Specialist salary (IV)	person-month	18	20,000,000	360,000,000	15,824
5	Specialist salary (IV)	person-month	24	20,000,000	480,000,000	21,099
4	Local stays and allowance	person-day	1.8	520,000	936,000	41
5	Traveling expenses	Trip/ person	100	3,000,000	300,000,000	13,187
6	Training course	class	20	10,000,000	200,000,000	8,791
8	Office and communication	month	60	5,000,000	300,000,000	13,187
	Total				**2,720,936,000**	**119,602**

6.9. GRIEVANCE REDRESS MECHANISM (GRM)

Complaints relating to any subproject's problems will be solved through negotiations to achieve the consensus. A complaint will go through three stages before it can be transferred to the court. The enforcement unit will pay all administrative and legal fees relating to the acceptance of complaints. This cost is included in the project budget.

Complaint procedures and resolution will be performed as follows:

The first level *People's Committee of ward/commune*. An affected household is to take his/her complaint to any member of the People's Committee of the ward / commune, through the village head or directly to People's Committee of the commune / ward, in written or oral form. The said member(s) of the People's Committee or the village head will inform the People's Committee of the ward/commune on the complaint. The People's Committee of Ward/Commune will work directly in person with the said affected household and will decide on the settlement of the complaint 5 days after receiving such complaint (this may take 15 days in mountainous or remote areas). The Secretariat of the People's Committee of the relevant commune/ward is responsible for documenting and recording all the complaints that it is handling.

After the Ward/Commune People's Committee issues its decision, the relevant household can make an appeal within 30 days. In case a second decision has been issued but the said household is still not satisfied with such decision, such household can appeal to the municipal (city) People's Committee (CPC).

The second level *The CPC*. Upon receiving a complaint from a household, the CPC will have 15 days (or 30 days in case of remote and mountainous areas) after receiving the complaint to resolve the case. The CPC is responsible for filing and storing documents on all complaints that it handles.

When the CPC has issued a decision, the household can make an appeal within 30 days. In case a second decision has been issued and the household is still not satisfied with such a decision, they can appeal to the Provincial People's Committee (PPC).

The third level *The PPC*. Upon receiving a complaint from the household, the PPC will have 30 days (or 45 days in case of remote and mountainous areas) after receiving the complaint to resolve the case. The PPC is responsible for filing and storing documents for all complaints to be submitted.

After the PPC has issued a decision, the household can appeal within 45 days. In case a second decision has been issued and the household is still not satisfied with such decision, they can appeal to the court within 45 days. The PPC will then have to pay the compensation into an account.

The Forth level *Provincial Court*. In case a complainant brings his/her case to a provincial court and the court rules in favor of the complainant, the provincial authorities will have to increase the compensation up to such a rate as may be ruled by the court. In case the court's ruling is in favor of the PPC, the complainant will be refunded the amount of money that has been paid to the court.

The decision ruling the settlement of complaints will have to be sent to complainants and concerned parties, and shall be publicly posted at the headquarters of the People's Committee of the relevant level. The complainant will receive such ruling three days after the result of complaint resolution at the ward / commune / town level has been decided upon and 7 days at the district or provincial level.

Personnel: The environment and resettlement staff chosen by the PMU will design and maintain a database of the project-related complaints from affected households, including information

such as: the nature of the complaint, the source and date of receipt of the complaint, the name and address of the complainant, action plan, and current status.

For oral complaints, the receiving / mediator board will record these requests in a complaint form at the first meeting with the affected person.

Contractor and Construction Supervision Consultant:

During construction, the GRM will also be managed by the contractors under supervision of the CSC. The contractors will inform the affected communities and communes about the GRM availability to handle complaints and concerns about the project. This will be done via the community consultation and information disclosure process under which the contractors will communicate with the affected communities and interested authorities on a regular basis. Meetings will be held at least quarterly, monthly information brochures will be published, announcements will be placed in local media, and notices of upcoming planned activities will be posted, etc.

All complaints and corresponding actions undertaken by the contractors will be recorded in project safeguard monitoring reports. Complaints and claims for damages could be lodged as follows:

- Verbally: direct to the CSC and/ or the contractors' safeguard staff or representatives at the site offices.
- In writing: by hand-delivering or posting a written complaint to specified addresses.
- By telephone, fax, e-mails: to the CSC, the contractors' safeguard staff or representatives.

Upon receipt of a complaint, the CSC, the contractors' safeguard staff or representatives will register the complaint in a complaint file and maintain a log of events pertaining to it thereafter, until it is resolved. Immediately after receipt, four copies of the complaint will be prepared. The original will be kept in the file, one copy will be used by the contractor's safeguard staff, one copy will be forwarded to the CSC, and the fourth copy to the PPMU within 24 hours since receipt of the complaint.

Information to be recorded in the complaint log will consist of:

- The date and time of the complaint.
- The name, address and contact details of the complainant.
- A short description of the complaint.
- Actions taken to address the complaint, including contact persons and findings at each step in the complaint redress process.
- The dates and times when the complainant is contacted during the redress process.
- The final resolution of the complaint.
- The date, time and manner in which the complainant was informed thereof.
- The complainant's signature when resolution has been obtained.

Minor complaints will be dealt with within one week. Within two weeks (and weekly thereafter), a written reply will be delivered to the complainant (by hand, post, fax, e-mails) indicating the procedures taken and progress to date.

The main objective will be to resolve an issue as quickly as possible by the simplest means, involving as few people as possible, and at the lowest possible level. Only when an issue cannot be resolved at the simplest level and/ or within 15 days, will other authorities be involved. Such a situation may arise, for example, when damages are claimed, the to-be-paid amount cannot be resolved, or damage causes are determined.

Independent monitoring consultants (environmental, social and resettlement), who have enough the specialized capacity, would be selected by PMU through bidding. Independent monitoring consultants are responsible for checking the procedures and decisions on settling complaints. Independent monitoring consultants may propose additional measures to address any outstanding complaints. While checking the procedure for complaint resolution and reviewing the decision on complaint resolution, the independent monitoring agencies are required to closely coordinate with the Vietnam Fatherland Front, whose members are responsible for monitoring law enforcement of local complaints.

***World Bank Grievance Redress Mechanism*:** Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-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 project-related concerns. Project 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 DISLCOSURE

This Chapter describes the process and results of public consultations as required in the national and Bank environmental safeguard policies. It describes feedback and options received from each ward or commune-based consultation and evidence of broad community support for the subproject investments. The Chapter also summarizes responses and commitments of the subproject owner in complying with the environmental and social mitigation measures and information disclosure.

7.1. SUMMARY OF PUBLIC CONSULTATION

The World Bank's Environmental Assessment Policy (OP/BP4.01) and the Involutionary Resettlement Policy (OP/BP 4/12) require to conduct public consultation and information disclosure to the affected peoled and local authorities on the environmental and social issues during the project preparation. The public consultation during the preparation of the project's ESIA also complies with the requirement in the Government's Decree No. 18/2015/ND-CP dated 14 February 2015 and the Circular No. 27/2015/TT-BTNMT dated 29 May 2015 by the Ministry of Natural Resources and Environment on environmental assessment and environmental safeguard plan.

The public consultation is conducted with the objectives: (i) to share all information related to the project's investments and expected activities to the local community and stakeholders; and (ii) to gather opinions/comments and concerns from local authorities and the communities. On such basis, the concerns of the local communities are addressed appropriately in the ESIA and the project design options.

7.1.1. Summary on public consultation at communal level and with organization directly affected by the project

To prepare the EIA report of the project "Dynamic Cities Integrated Development Project – Hai Duong city, Hai Duong province", Consultant conducted public consultations to collect feedbacks from People's Committees and Fatherland Front Committees of 10 wards/communes in the city.

After the draft Environmental Impact Assessment report has been prepared, the Project Management Unit conducted public consultations in each ward on the content of the draft. At the same time, the Project Management Unit also sent written requests for consultations with stakeholders. The schedule of consultations with People's Committees of wards in the project area is shown in the table below:

Table 7.1: Public consultation at ward People's committee on environmental impact

No	Ward	Request for comment from People's committee and Fatherland Front Committee	Feedback from People's Committee	Feedback from Fatherland Front Committee
1	Thanh Binh ward	Official dispatch	Official dispatch	Official dispatch
2	Tan Binh ward	Official dispatch	Official dispatch	Official dispatch
3	Nhi Chau ward	Official dispatch	Official dispatch	Official dispatch

No	Ward	Request for comment from People's committee and Fatherland Front Committee	Feedback from People's Committee	Feedback from Fatherland Front Committee
4	Tu Minh ward	Official dispatch	Official dispatch	Official dispatch
5	Tran Hung Dao ward	Official dispatch	Official dispatch	Official dispatch
6	Tran Phu ward	Official dispatch	Official dispatch	Official dispatch
7	Cam Thuong ward	Official dispatch	Official dispatch	Official dispatch
8	Binh Han ward	Official dispatch	Official dispatch	Official dispatch
9	Viet Hoa ward	Official dispatch	Official dispatch	Official dispatch
10	Ngoc Chau ward	Official dispatch	Official dispatch	Official dispatch

7.1.2. Summary on public consultations with people directly affected by the project

Public consultations were conducted after completion of the draft EIA report of the project. The Project Management Unit co-operated with ward People's Committees in co-chairing public consultation meetings from November 22 to November 24 in 10 wards of Hai Duong city. Consultations with the Women's Union, the Veterans Association, the Youth Union, the Farmer's Union, Fatherland Front Committee were to identify additional impacts as well as to seek feedbacks on the mitigation measures for the project. The public consultations focused in the summary of the EIA report with main impacts and affected people as well as mitigation measures which will be implemented in each ward so that community and representatives of local authority, trade union and associations can make comments and give feedbacks.

7.2. PUBLIC CONSULTATION RESULTS

7.2.1. Feedbacks of People's Committees of wards affected directly by the project

Comments from People's Committees and Fatherland Front Committees of wards on content of the EIA report are presented in table below:

No	Ward	Comments from ward People's Committees and Fatherland Front Committees	Project owner's feedbacks and commitment
1	**Tran Phu ward**	• **Project's migitation measures for environmental impacts:** - Tran Phu ward PC agrees with migitation measures for environmental impacts proposed in the report summary. • **Recommendation for Project owner:** - Labor safety, local security and order should be ensured during construction process. - Project owner should strictly follow commitment in applying mitigation measures to prevent and minimize bad environmental impacts.	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front Committee - Impacts and mitigation measures have been included in the EIA report. - Project owner should work with stakeholders to monitor contractor's implementation of environmental mitigation measures.
2	**Tran Hung Dao**	• **Project's migitation measures for environmental impacts:** - Tran Hung Dao ward PC agrees with	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front

No	Ward	Comments from ward People's Committees and Fatherland Front Committees	Project owner's feedbacks and commitment
	ward	migitation measures for environmental impacts proposed in the report summary. • **Recommendation for Project owner:** - Project owner should implement mitigation measures proposed in the report and strictly monitor the implementation of mitigation measures	Committee - Impacts and mitigation measures have been included in the EIA report. - Project owner should work with stakeholders to monitor contractor's implementation of environmental mitigation measures.
3	**Binh Han ward**	• **Project's migitation measures for environmental impacts:** - Binh Han ward agrees with migitation measures for environmental impacts proposed in the report summary. • **Recommendation for Project owner:** - Project owner should strictlyensure labor safety and implement mitigation measures for environmental impacts as proposed in the summary report	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front Committee - Impacts and mitigation measures have been included in the EIA report. - Project owner should work with stakeholders to monitor contractor's implementation of environmental mitigation measures.
4	**Ngoc Chau ward**	• **Project's migitation measures for environmental impacts:** - Ngoc Chau ward agrees with migitation measures for environmental impacts proposed in the report summary. • **Recommendation for Project owner:** - Project owner should strictly follow commitment in applying mitigation measures to prevent and minimize bad environmental impacts. - Project owner should strictlyensure labor safety and shield the construction site during construction process.	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front Committee - Impacts and mitigation measures have been included in the EIA report. - Project owner should work with stakeholders to monitor contractor's implementation of environmental mitigation measures.
5	**Nhi Chau ward**	• **Project's migitation measures for environmental impacts:** - Nhi Chau ward agrees with migitation measures for environmental impacts proposed in the report summary**.** • **Recommendation for Project owner:** - Labor safety, local security and order should be ensured during construction process. - Project owner should pay attention to environmental impacts during construction such as: workers' domestic wastes, hazardous wates and should apply mitigation measures	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front Committee - Impacts and mitigation measures have been included in the EIA report. - Project owner should work with stakeholders to monitor contractor's implementation of environmental mitigation measures.

No	Ward	Comments from ward People's Committees and Fatherland Front Committees	Project owner's feedbacks and commitment
		for dust, gas, noise, etc.	
6	**Cam Thuong ward**	• **Project's migitation measures for environmental impacts:** - Cam Thuong ward agrees with migitation measures for environmental impacts proposed in the report summary. • **Recommendation for Project owner:** - During construction process, construction contractor should not occupy roadbed for gathering material, affecting local people's movement. Appropriate machineries should be used to minimize noise and vibration. - Project owner should strictly follow commitment in applying mitigation measures to prevent and minimize bad environmental impacts.	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front Committee - Impacts and mitigation measures have been included in the EIA report. - Project owner should work with stakeholders to monitor contractor's implementation of environmental mitigation measures.
7	**Quang Trung ward**	• **Project's migitation measures for environmental impacts:** - Quang Trung ward PC agrees with migitation measures for environmental impacts proposed in the report summary. • **Recommendation for Project owner:** - Project owner should pay attention to environmental impacts during construction such as: workers' domestic wastes, hazardous wates and should apply mitigation measures for dust, gas, noise, etc. - Project owner should implement mitigation measures proposed in the report and strictly monitor the implementation of mitigation measures	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front Committee - Impacts and mitigation measures have been included in the EIA report. - Project owner should work with stakeholders to monitor contractor's implementation of environmental mitigation measures.
8	**Thanh Binh ward**	• **Project's migitation measures for environmental impacts:** - Thanh Binh ward agrees with migitation measures for environmental impacts proposed in the report summary. • **Recommendation for Project owner:** - Project owner and construction contractor should calculate rainfall and wastewater to construct appropriate drainage system to reduce flooding. - Project owner should strictly follow commitment to ensure environmental sanitation for project area.	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front Committee - Impacts and mitigation measures have been included in the EIA report. - Project owner should work with stakeholders to monitor contractor's implementation of environmental mitigation measures.

No	Ward	Comments from ward People's Committees and Fatherland Front Committees	Project owner's feedbacks and commitment
9	**Tan Binh ward**	• **Project's migitation measures for environmental impacts:** - Tan Binh ward agrees with migitation measures for environmental impacts proposed in the report summary. • **Recommendation for Project owner**: - Labor safety, local security and order should be ensured during construction process.	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front Committee - Impacts and mitigation measures have been included in the EIA report. - During construction, project owner will cooperate with stakeholders to monitor contractor's implementation of mitigation measures.
9	**Viet Hoa ward**	• **Project's migitation measures for environmental impacts:** - Viet Hoa ward agrees with migitation measures for environmental impacts proposed in the report summary. • **Recommendation for Project owner:** - During construction, construction contractor should shield the construction site to minimize dust and noise. - Project owner should strictly follow commitment in applying mitigation measures to prevent and minimize bad environmental impacts.	- Project Management Unit notes comments of the ward People's Committee and Fatherland Front Committee - Impacts and mitigation measures have been included in the EIA report. - Project owner should work with stakeholders to monitor contractor's implementation of environmental mitigation measures.

7.2.2. Comments of communities directly affected by the project

Consultations with affected people's committees were conducted from 22nd to 24th November, 2017, with the following main contents:

- Presenting an overview of the project, identifying project area.
- Introducing World Bank safeguards policies on environment and resettlement.
- The current status of environmental sanitation of works in wards' areas and outstanding issues.
- Solutions contributed by the community to minimize the environmental impacts and solutions from associations in the implementation process of the project.
- Comments for the construction works.

Public consultation was conducted in 10 wards in Hai Duong city. The content, time and place of consultations are shown in the table below:

Table 7.2: Result of public consultation

Location	Comment	Project owner's feedback
Thanh Binh ward PC	**Local people totally support the project:** - There are some households renting house, population in the ward is not stable, difficult for inventory and measurement survey. - At present, local people are bearing wastewater drainage cost, if the project is brought into operation, people wish that the cost for water drainage will not change much. - During construction process, construction contractor should not occupy roadbed by placing material uncontrolly, affecting people's traffic condition. - The project will bring positive impacts and improve environmental sanitation for local people. - Compensation should be reasonable for all people losing land. - Local people should get priority in being recruited to work for the project. - Mitigation measures should be implemented during the construction phase.	- Project owner notes the comments and will assess the actual situation in the local area to have appropriate, reasonable and effective design, construction options and policy. - Project owner will follow commitments to organize public meetings and disclose information to local people when the project is approved.
Ngoc Chau ward PC	- Agree with the mitigation measures stated. - During the construction process, the project owner and the construction contractor have to take measures to minimize the impact of dust, noise on the environment and life of people in the area. - Works affected by the construction activities of the project must be restored. - The compensation price must be the market price.	
Nhi Chau commune PC	- Agree with the project's policy, but it should clarify the treatment/operation method of the treatment plant. Resettlement and site clearance issues need to be clarified. - Restore the ground after construction for the people. - Minimize land acquisition. - Comply with technical requirements, meet the standards on environmental protection. - *Recommendation for Project owner:* + Restore the site after construction of water drainage pipeline. + Minimize land acquisition for all items in the commune. + In addition, all environmental protection measures must be implemented throughout the construction period to avoid negative impacts on the health and well-being of the people, roads, household businesses living near the road, bridge, pumping station, sewer. - Recruit people as workers in the process of project implementation.	
Tan Binh ward PC	- Local people totally agree with the construction items in the area. - The wastewater collection system will face many difficulties as the households have built solidly and due to people's habits so survey should be conducted prior to project implementation. - *Recommendation for Project owner*: + The Consultant as well as the project management unit should coordinate with the local authorities to avoid overlapping in zoning the project scope. + Complete the compensation before construction. + Compensation at market price. + Full implementation of environmental protection measures to avoid negative impacts on local people.	

Location	Comment	Project owner's feedback
	+ Recruit local workers to reduce immigrant pressure.	
Tran Hung Dao ward PC	Recommendation for Project owner: - Project owner should pay attention to environmental impacts during the construction process, including: workers' domestic waste, hazardous waste of construction works and measures to deal with gas, dust and noise. - Project owner should comply with commitments on handling measures to prevent and mitigate adverse impacts on the environment. - Compensation and support must be adequate for APs. - Construction contractors should well manage workers, avoid causing public disorder and security. - Project owner should thoroughly study the implementation plan and scope of the project: expand the embankment area to the weir, support to improve the landscape of the weir reservoir, support the construction of connection system from household to general system. - Local people will support project activities such as site clearance, project information dissemination to the people.	
Binh Han ward PC	- During construction, the labor safety must be absolutely ensured and the measures of mitigating negative impacts on the environment must be properly implemented as stated in the draft report. - Spray water to limit dust generation - Attention should be paid to the construction of drainage sewers to avoid localized inundation in zones 3 and 4 in the ward area. - Avoid gathering materials along the road, completing works as scheduled. - Priority should be given to recruiting people to implement the project. - Mitigation measures must be implemented during the construction phase. - Households who lose their livelihoods want to receive livelihoods support and want to be recruited for the project operation phase. - Improve the cemetery landscape to have a better aesthetic view of the entire area.	
Cam Thuong ward PC	- - It is recommended that the investor, the construction unit calculate the amount of rain water and wastewater to make the drainage system suitable to drain water. Construct waste collection system for people in the area - During construction, to ensure labor safety and to cover the works	
Tu Minh ward PC	- During construction process, it is recommended that the construction contractor not to spread construction materials occupying the road, affecting people's traffic condition in the area. - Use appropriate machinery to reduce noise and vibration - Implement the project quickly - Compensation must be clear and timely implemented to stabilize the lives of people. - During construction, to ensure clean water sources; minimize waste generation.	
Tran Phu ward PC	- Local people agree with the project's policy, but it should clarify the treatment/operation method of the treatment plant. Resettlement and site clearance issues need to be clarified. - Recommendations to the project owner: - It is necessary to have support policies and information disclosure to affected households if the project	

Location	Comment	Project owner's feedback
	is prolonged. - Follow construction schedule in order to avoid affecting the daily life of the people - Construction contractors should well manage workers, avoid causing public disorder and security.	
Viet Hoa ward PC	- Agree with the mitigation measures given. Project owner to take seriously to minimize the environmental impact on people's lives. - Detailed construction schedules should be provided to local people for construction of culvert and pumping station. - There are some restrictions on existing facilities such as power lines, pavements, trees, etc .; - Priorize to recruit local people for project implementation; - Existing facilities must be restored in case of damage. - Site clearance must be completed before commencement of construction; - The compensation price must reflect the market price;	

In general, the local communities have made positive comments on the project. They are aware of the positive and negative impacts that the project brings and expects the project to be implemented soon. However, people also wish that, during the project implementation, especially during the construction period, project's owner and contractors should pay attention to the following issues:

- To disseminate information on construction progress to local people so they can organize their work and daily life to minimize inconvenience during construction. Strengthening construction method should be introduced to avoid widespread construction on the entire area and to narrow the scale of influence.
- To provide necessary assistance to business households who are directly or indirectly affected by the construction process.
- To minimize any delays in construction progress to avoid direct impacts on household income and daily life.
- To minimize dust and noise when transporting materials which are collected from the construction site
- To restore the road surface at least to its original state and to minimize the repetition of soil excavation and backfilling on the same route.
- The project owner must be present at the construction site to closely manage the construction contractor's activities and ensure contact liason so that people can contact in an emergency.

CHAPTER 8. CONCLUSIONS, RECOMMENDATIONS AND COMMITTMENTS

8.1.CONCLUSIONS

The "**Dynamic Cities Integrated Development Project – Hai Duong City Sub- Project"** is a improved basic urban infrastructure project of which the main work includes: (i) Completion of technical infrastructure for main roads in the west of the city to facilitate people's transport; rehabilitation of drainage system to prevent urban flooding and inundation; improvement of environmental sanitation and people's living condition; supporting urban sustainable development, green and smart urban centers in responding to climate change. Hai Duong project will help to improve the city's drainage conditions, local flooding and environmental conditions, contributing to the sustainable growth of the city.

The contents of ESIA report comply with the current requirements for environmental impact assessment stipulated by the Vietnamese Government and WB's policies. The report will be one of the key documents to be submitted to State management agencies in charge of the environment to determine the location and scope of the work as a basis for applying for an investment license. In addition, this is also an important document helping the project appraisal and in the negotiation and signing of the loan agreement between the Government of Vietnam and the World Bank.

Environmental impacts:

The environmental impacts were theoretically and empirically assessed with support from the baseline and statistical data as well as experiences from similar WB projects. The impacts are relatively quantified as best as they can be for all three stages of project's preparation, construction and operation and will be further assessed and adjusted during the project implementation in order to mitigate the negative impacts and enhance the positive ones.

The positive impacts of the project include (i) improved environmental conditions and urban landscape in many public and residential areas; (ii) increased wastewater collection and treatment; (iii) minimized discharge of untreated wastewater into the environment; (iv) reduction of public health risks associated with water-born diseases and related healthcare cost; (v) reduction of traffic jam or safety risks caused by inundation; (vi) increased the accessibility of local people to nearby areas.

Most of the impacts during the pre-construction and construction stages are temporary and short-term, taking place in areas around construction sites or on transport routes and at disposal sites. The main impacts during the site preparation relate to the acquisition of land affecting residential land, agriculture land and small areas around fences of some religious facilities and local residents. In the construction phase, impacts from dust, vibration and noise as well as issues of social security and occupational safety are much likely to arise. In addition, the transportation and disposal of dredging sediments and materials will also be an area of concern. However, these can be limited or mitigated to the lowest levels by the implementation of the ESMP.

Subproject construction operations might cause a number of negative impacts on the social life of residents in the Subproject area, by bringing about changes in their living conditions and disturb their daily routines as well as production and economy. Emerging issues might include increase in air pollution and traffic accidents, land subsidence or breakdown of drainage or road system, accumulation of sediments and materials manholes or canals among others. Nevertheless, these impacts are short-term and can be mitigated.

Mitigation measures:

Measures to control pollution and limit adverse impacts on environment in the construction and operation phases proposed and recommended in this report. Besides the application of appropriate managerial and technical measures, awareness raising and behavior change communication to local people should be paid attention to help maintain the good environment. All the measures are proven to be feasible and able to meet Vietnamese environmental standards.

The environmental monitoring program will be carried out as soon as the State's approval and the license of subproject construction and operation have been obtained. Monitoring data will be stored and serve as a legal basis for compliance with the Environmental Protection Law of Vietnam as well as the environmental safeguard policies of World Bank. These data will also serve the evaluation of the effectiveness and environmental sustainability of the project.

An environmental and social management plan (ESMP) is in place to ensure the management, monitoring, reporting, preparation and adjustment of measures to minimize environmental pollution during project implementation. The project owner, contractors and project management unit, will be responsible for implementing this plan in cooperation with local state management agencies and authorities.

Public consultations have been conducted to share the project contents, potential environmental impacts and mitigation measures to local residents and concerned stakeholders. So far, the project has been receiving great support from the local communities and authorities.

8.2.RECOMMENDATION

This is an environmentally significant project, contributing to the sustainable growth of Hai Duong City and in particularly helping Hai Duong to achieve several key targets for becoming the class I city by 2020. Therefore, the Owner would like to propose for DONRE's appraisal and approval of the ESIA report of the project as well as WB's approval for timely and prompt deployment of the project.

During the Project implementation, the Project PMU/ Project owner would seek the participation, coordination, support and constructive comments from line departments and local authorities in carrying out the environmental protection efficiently. In particular, the Project would like DONRE to provide capacity support for PMU staff and related operational workers in the areas of environmental compliances and environmental management and awareness raising and communication on environmental protection to local people.

In order to ensure the synergy between this project and other investments of the city, PMU would like to urge the PC to accelerate the implementation and operation of the proposed waste and wastewater treatment facilities so that the project can connect into.

8.3. COMMITMENT OF IMPLEMENTATION

During the operation of the project, the Owner commits to carrying out seriously the regulations of Vietnam's environmental protection laws, including: the Law on Environmental Protection No.55/2014/QH13 passed by the National Assembly of the Socialist Republic of Vietnam dated 23 June, 2014; Decree No.80/2014/ND-CP dated 6 August, 2014 by the Government on drainage and wastewater treatment; Decree No.19/2015/ND-CP dated 14 February, 2015 by the Government detailing the implementation of some Articles of the Law on Environmental Protection; Decree No.18/2015/ND-CP dated 01 April, 2015 by the Government on environmental protection

planning, strategic environmental assessment, environmental impact assessment and environmental protection plan; Circular No.27/2015/TT-BTNMT dated 29 May, 2015 by MONRE on strategic environmental assessment, environmental impact assessment and environmental protection plan, and other relevant documents. The Owner also commits to complying with WB's environmental safeguard policies.

In addition, the Client commits to carrying out environmental protection and mitigation measures as mentioned in Chapter 5 and implementing the environmental and social management plan for the Subproject as mentioned in Chapter 6, and fulfilling commitments towards the communities specified in Chapter 7. The Owner also commits to make compensation and overcoming environmental pollution once environmental incidents and risks occur during the implementation of the project and taking steps of environmental recovery in accordance with to legal regulations on environmental protection when subproject operation has been completed.

APPENDIX 1: DCIDP HAI DUONG SUB-PROJECT DREDGED MATERIALS MANAGEMENT PLAN

1. Location of Dredging, Volume and Characteristics of Dredged Materials

-Dredging and Upgrading of Bach Dang river. The volume of dredging materials estimated about 4,640 m^3.

- Dredging and Upgrading of T1 cannal. The volume of dredging materials estimated about 6,400 m^3.

-Dredging and Upgrading of Nghe lake. The volume of dredging materials estimated about 67,531 m^3.

2. Final Disposal Site

According to the analyses in chapter 2, the sediments from the river, cannal and lake dredging work are not hazardous, with heavy metals lower than the acceptable limits. However, the dredging soils and sediments have high amount of organic compounds and pathogenic microorganisms (e.g. Ecoli) thus should not be used directly for agricultural purpose. It is recommended the sediments would be dewatered and kept at least 03 months to allow partial biodegradation of organic substances and removal of microbial organisms. The sediments could then be used for perennial crops or planting tree for urban landscape purpose, based on the actual needs of local people. Otherwise, it will be transported and disposed at Tu Minh landfill

The disposal site- Tu Minh landfill is away approximately from 18 km to 23 km from dredging area.

Although a separate management plan is prepared for the excavated materials of the entire project, disposals of the excavated materials will also follow the above principles. During construction phase additional tests for deeper layer will also be carried out by the contractors.

3. Contractor's Dredging Management Plan

The Contractor is required to prepare a Contractor's Dredging Management Plan (CDMP) and submitted to the Environmental Consultant of the Construction Supervision team and the PMU Environmental Officer for review and approval. The CDMP will include, but not limited to the followings:

1) The Scope of Works in the Contract package, construction method and schedule

2) Volume and quality of water quality and sediment quality in the dredging area covered by the contract

3) Water users that may be affected by the dredging and embankment lining

4) Materials uploading and transportation method: indicate proposed route of the transport from the dredged site to the disposal area, time of operation, type of vehicles/trucks and proposed measures to reduce the leakage of the dredged materials from the transport trucks,

5) Schedule to inform the nearby communities about the project, disclosure of name and contact number for possible complaints.

6) Potential social and environmental impacts, including the site-specific impacts and risks

7) Mitigation measures to address the potential impacts and risks. The mitigation measures should be proposed based on ESIA/ECOP, ESMP, SEMP, the potential

impacts and mitigation measures presented in Section 4 and 5 of this Plan and the following requirements:

8) Environmental Quality Monitoring plan carried out by the contractor (particularly pH,DO, TSS, BOD, salinity etc. for water and heavy metals including pH, Hg, As, Cd, Cu, Pb, Zn and Cr, Organic Materials and Mineral Oils for sediments and soil

9) For soil and sediment: The number of samples taken will follow the following guidelines

Table 1 . The number of Sediment samples

Volume of dredged (m^3)	**No of Sediment Samples**
Up to 25,000	3
25,000 to 100,000	4-6
100,000 to 500,000	6-10
500,000 to 2,000,000	10-20
For each 1,000,000 above 2,000,000	Additional 10

At least one water, soil and sediment sample must be taken for each contract package

- Consultation with affected community about the draft CDMP
- Excavated soil are separated from dredged materials from source. Excavated soils will be reused on-site and off-site as much as possible and transported to the nearest disposal site appraised under ESIA, or identified and approved during detail engineering design or construction phase;
- The mitigation measures are adequate to address the potential social and environmental impacts associated with various steps and activities, areas of influence and receptors of dredging, temporary storage, transportation and final disposal of the dredged materials.
- Field survey are carried out by the Contractor during the preparation of the CDMP in order to identify if there are additional sensitive receptors not identified previously under CCSEP and proposed additional site-specific mitigation measures accordingly.
- Contractor's environmental monitoring plan are included
- Commitments to carry out corrective actions when excessive pollution is determined, or when there are complaints about environmental pollution, social impacts from any stake holders

4.Potential Impacts and Mitigation Measures for Dredging and Embankment lining

Impacts and Description	Mitigation Measures
AT DREDGING and TEMPORARY LOADING AREAS	
Odour and air pollution, nuisance Decomposition of organic matters under anaerobic conditions generates strong odour-generated gases such as SO_2, H_2S, VOC etc. When the muds are disturbed and excavated, these gases are released much faster into the air. Exposure to odour pollution affect the health of workers, local residents and cause public	- Inform the community at least one week before dredging is started - Minimise the duration of temporary loading of dredged materials on-site - temporary loading materials must be transported to the disposal site within 48 hours - Load the materials on-site tidily - Do not load the materials temporarily outside

Impacts and Description	Mitigation Measures
nuisance	the construction corridor determined for each canal section - Avoid loading the sludge in populated residential areas or near public buildings such as kindergarten. Load the sludge as far from the houses and buildings as far as possible - Cover the temporary sludge loads when loading near sensitive receptors or longer than 48 hours unavoidable
Dust and nuisance Temporary loading of sludge at the construction site cause nuisance to the public Dry and wet mud may be dropped along the dredging area and on transportation route causing nuisance to the public and traffic safety risks	- Avoid temporary loading of dredged materials on-site - Dredged materials must be transported to the final disposal sites earliest possible and no later than 48 hours from dredging. - Use truck with water-tight tank to transport wet/damp dredged materials; - All trucks must be covered tightly before leaving construction site to minimise dust and mud dispersion along the road
Traffic Disturbance The placement and operation of dredging equipment and construction plants on the ground, temporary loading of the dredged materials may obstruct or disturb traffic and cause safety risks for the people travelling on the canal-side road, particularly on canal-crossing bridges which are usually very narrow	Arrange worker to observe and direct excavators driver when traffic is busy
Social Disturbance Concentration of workers and equipment, construction plants, temporary loading of materials and wastes, traffic disturbance, dusts and odour pollution etc. will disturb daily activities and the lives of local residents Conflicts may also be arisen if workers, waste, materials, equipment etc. are present outside the construction corridor	- Inform the community at least one week before construction is started - Monitor to ensure that physical disturbances are within the construction corridors only - Contractor recruit local labours for simple works, brief them about project environmental and safety requirements before started working - Contractor register the list of workers who come from other localities to the commune at the construction site - Led the water leaked from wet/damp dredged materials going back to the river, not to affect garden or agricultural land - Keep the areas to be disturb minimal - Enforce workers to comply with codes of conducts
Landslide and soil subsiding risks at dredging area Relative deep excavation or cut and fills on the embankments that create slopes may lead to	- During field survey for the preparation of CDMP, the contractor in coordination with the Environmental Officer of PMU and the Environmental Consultant of the CES identify weak structures that may be at risk

Impacts and Description	Mitigation Measures
landslide and soil subsiding at the slops or excavated areas, particularly in rainy weather Deep excavation also cause risks to the existing buildings nearby, particularly the weak structures or located too close to the deep excavation area.	and determine appropriate mitigation measures accordingly - Consider and select appropriate dredging method that allow minimising soil subsiding risks, for example carry out stepped excavation, stabilise slops in parallel to dredging - Apply protective measures such as sheet piles at risky locations
Water Quality Degradation Turbidity in water will be increased when the mud is disturbed; Water leaked from dredged material and suface runoff through disturbed ground also contain high solid contents. Muddy water entering irrigation ditch will cause sedimentation. Aquatic livest in the canal would also be affected by turbid water.	- Build coffer dams surrounding the dredging area and pump the water out before starting dredging - If dredging is carried out directly onto the water, dredge at intervals to allow suspended materials to resettle before continuing. Observe water colour at 20 m upstream and stop dredging when water colour there started to change
Increased Safety risk for the Public	- Place stable barriers along the construction corridor boundary to separate the site with nearby structures - Place warning signs and reflective barriers along the construction area, at dangerous locations and within sensitive receptors - Ensure adequate lighting at
Health and Safety risk to the workers The health of workers may be affected due to exposure to odour and other contaminants from sludge Risk of being drown	- Within two weeks before dredging is started, the contractor will coordinate with local authority to identify good swimmers or those who can dive in the locality, and hire at least one of them at each canal construction site deeper than 3 m and there are workers working on or near water surface. - Provide and enforce the workers to use masks. If and when working in the water, protective cloths, rubber boots, gloves and hats must be wore.
Others	- Other relevant measures specified in ECOP or proposed by the contractors as necessary
MATERIAL LOADING AND TRANSPORTATION	
Dust and nuisance, traffic safety risks Dust or wet materials may be dropped along the transportation route	- Use water-tight tank trucks for transporting wet/dam materials - Cover the materials tightly before leaving the construction site - Do no overload material on the trucks
AT FINAL DISPOSAL SITE	
Landslide and soil subsiding risks at final Disposal site	- Level the materials after being disposed off - Slopes of the dumps will not be steeper than 45o

Impacts and Description	Mitigation Measures
Landslide and subsiding risk may happen on slopes created at the final disposal site of dredged materials if the slopes created are too high, steep or unstable	- Build/create the walls to protect slopes - Create and maintain drainage at the foot of each dump higher than 2 m
Soil and Water Quality Pollution - The disposal of salty soil would not affect the existing soil quality - No risks of subsidence and landslide for residential areas around this area - No impacts on river water quality.	- Apply measures that ensure rainwater onto the materials is not mix with the surface runoff from the surrounding to overflow uncontrolled at the site; rainwater will be infiltrated onto the ground on-site. This can be done by the following mitigation measures: + Build drainage ditches surrounding the designated disposal area + Use impermeable materials to cover the walls surrounding the materials to isolate it with the surrounding + Other measures proposed by the contractors to meet pollution control targets

5. Specific Guidance for Dredging at Bach Dang river, T1 cannal and Nghe lake

- Identifying the available land for disposing the dredged materials. The plan should also identify the possible lands to be appropriated for the disposal of dredged materials. Public land, land for construction of rural roads, public works, private land, etc. may be used, with an agreement with the project affected households. It should also meet local plans for land use.
- Preparing for a transportation plan. In case, the dredge disposal area is far away from the dredged sites, the DMP shall set out a transportation plan including: (a) methods of transportation (pipeline, barges, hopper barges) and uploading to the disposal area. If trucks are used, indicate proposed route of the transport from the dredged site to the disposal area, (b) time of operation, (c) type of vehicles/trucks and proposed measures to reduce the leakage of the dredged materials from the transport trucks, (d) contractors' responsibilities for cleaning the roads and carry out remedial works if necessary, and (e) a communication plan for the nearby communities including contact number for possible complaints.
- Plan for managing the disposal areas including: (a) plan for reducing the drainage, (b) construction of the perimeter dykes, (c) construction of sub-containment area, if applicable, (d) planned thickness of the dredged materials (typically less than 1.5 meters), (e) any measures to protect ground water and soils (e.g., installation of PVC membrane).
- Designing the Draining for Disposal lands. As the dredged materials are in the state of mud at first and soil particles are suspended for 24 to 48 hours. All drainage water from disposal land shall be driven to the drains and discharged back to the river. In order to limit the negative impacts of mud (produced by dredging) on the environment as well as the water quality of the canals, the dredged sediment will be transported to a containing area which is appropriately located and properly design with an adequate size. The dredged spoil will be pumped to the disposal land and then overflow to a settlement pond, where turbidity and total suspended solids are settled. After some time, effluent is returned to the river. A typical design of the dike around each disposal may be as follows:

Height: 2m, Footing width: 5 m, and Surface width: 1m. The plan should set out a basic layout.

- Monitoring the Disposed Dredged Materials. A plan for monitoring the dredged materials as well as water quality of effluent would be required. As stated before, an intensive monitoring would be required if the dredged materials contains higher content of the heavy metals and other harmful materials than the national thresholds.
- In order to mitigate the issue of turbidity during dredging operation, the DMP shall set out dredging equipment and/or techniques suitable to the particular site. On laying dredging machines on a barge, contractors can use a proper mud –stopping net for enclosing the dredging site and keeping back mud on land, not to let it goes back to the canal. If the disposal site for dredge materials is located far away from the dredger, a suction dredger should be used to transfer all the mud and soil in water to the disposal sites. The length of dredging sections should be limited less than 1 km and the dredging should be done one by one.
- At the completion of the contract, carry out an assessment on dredged materials, and determine the use of the dredged materials for activities such as: (a) construction (roads and dykes), (b) basis for individual houses, and (c) gardening

APPENDIX 2: DUE DILIGENCE REVIEWS

Due diligence reviews related to Hai Duong city project are conducted for (1) Tu Minh landfill in Tu Minh ward, Hai Duong city; (2) Seraphin Hai Duong waste treatment plant in Viet Hong commune, Thanh Ha district, Hai Duong province. Detailed assessment is presented in following table:

01. Project's Name	**Tu Minh landfill in Tu Minh ward, Hai Duong city**
Description	Tu Minh landfill has land area of 41,514 m^2 located in Tu Minh ward in Hai Duong city. This is the disposal site of construction waste and solid waste from 21 wards and communes of Hai Duong city. It is managed and exploited by Hai Duong Transport Enterprise under Decision No. 5710/QĐ-UBND dated 6/12/2005 which approving allocation of 40,027 m^2 for construction of landfill in Hai Duong city and Decision No.03 dated 02/1/02007 allocating an area of 1,487 m^2. The landfill was constructed since 2005 with receiving capacity of 9,000m^3. At present, each month the landfill receives 1,125 tons of waste and about 135,000 tons each year. Discharge fee is 8,300VND/m^3 including leveling, burring and management fee. Dredging materials will be physically screened to remove garbage before being dumped to waste cells, sprayed with biological enzyme and covered with 20 cm layer of sand to minimize bad odor. After 2- 3 months being dewatered and pathogens removal, the material can be used for leveling purposes at the disposal site. The leachate from the landfill is stored in a lagoon next to the sanitized landfill. The leachate is often pumped back to the landfill to increase the moisture, accelerating the biological degradation processes. Water level in the lagoon is measured and controlled to avoid overflow, especially in the rainy season. The treatment of leachate in the pond follows chemical and biological treatment, disinfection and being discharge to the natural lake. *Link with the project:* All demolished material and excavated soil under the project will be transported to this landfill. Dredged materials from T1 canal, Bach Dang river and Nghe lake and Generated sludge from the wastewater collection and treatment system in the west of the city will be treated and buried. According to Hai Duong City'PC, Tu Minh landfill has enough land for disposal of dredging sludge and material of DCIDP project.
Existing status	In operation
EIA/EMP	EIA report was already approved by Hai Duong PPC
Due Diligence review	Tu Minh landfill in Tu Minh ward was designed and constructed in 2005 on an area of 4.1ha. Site clearance was already completed in 2005. So far, there have been no complaints on compensation and site clearance. Until now, the operation of Tu Minh land fill has not caused any pollution to the environment. Equipping workers with adequate labor protective gears has been already carried out.
02. Project's name	**Seraphin Hai Duong waste treatment plant in Viet Hong commune, Thanh Ha district, Hai Duong city**
Description	Seraphin Hai Duong waste treatment plant has total land area of 153,665 m^2

	receiving domestic waste in Hai Duong city and some communes in districts of Nam Sach, Thanh Ha and Kim Thanh. Domestic waste generated in Hai Duong city will be collected and transported to the plant where 2 waste burners are operating under management of Hai Duong APT-Seraphin Environmental Company. The plant operation capacity is 183 tons/day and was invested with about 5% of ODA fund. *Treatment of domestic waste:* 95% of domestic waste will be burned following the technological line designed and manufactured by Trang An Xanh limited company. 5% of the remaining domestic waste will be processed by proper burial method. *Industrial waste*: Normal industrial waste will be burned by Vinabima – 1000-RC01 burner supplied and installed by Vinabima Tien Son Construction Machinery Joint-stock company. **Monitoring and management plan:** Proper measures have been taken to ensure that **Seraphin Hai Duong waste treatment plant** is operated continuously in conformity with designed processes and with the expected efficiency of a operational process. The plant has signed a contract with the Center for analysis and testing (directly under Hai Duong provincial Department of Science and Technology) in order to periodically monitor the quality of soil, groundwater, air and leachate every 3 months; reports are to be prepared and submitted to the authorized units (DONRE, Department of Environmental Protection, Department of Provincial Environment Police, City People's Committee). Overall, the operation of the waste treatment plan has not caused any pollution to the environment. Equipping workers with adequate labor protective gears has been already carried out. *Link with the project:* All domestic waste generated under the project will be processed by Spanish technological line and Vinabima burner.
Existing status	In operation
EIA/EMP	the report was approved under Decision No 471/QĐ-UBND by Hai Duong PPC dated 25/1/2017
Due Diligence review	Land acquisition and site clearance were completed already. So far, there have been no complaints on compensation. All affected people have got proper compensation and support as provisions of relevant regulations. Until now, the operation of the waste treatment plan has not caused any pollution to the environment. Equipping workers with adequate labor protective gears has been already carried out.