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KHANH HOA PROVINCIAL PEOPLE'S COMMITTEE

COASTAL CITIES SUSTAINABLE ENVIRONMENT PROJECT (CCSEP)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

(Final Report)

NhaTrang City Subproject

Hanoi, November 2016

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(Final Report)

NhaTrang City Subproject

EMPLOYER	CONSULTANT
DEVELOPMENT PROJECT MANAGEMENT UNIT OF KHANH HOA PROVINCE	VIETNAM WATER, SANITATION AND ENVIRONMENT JSC.

Hanoi, November 2016

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ABBREVIATION

CCSEP	Coastal Cities Sustainable Environment Project
CCESP	Coastal Cities Environmental Sanitation Project
CSC	Construction Supervision Consultant
CSO	Combined sewer overflow
DED	Detail engineering Design
DOC	Department of Construction
DOF	Department Of Finance
DONRE	Department Of Natural Resources And Environment
IEMC	Independent Environmental Monitoring Consultant
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Impact Assessment
FS	Feasibility Study
WB	World Bank
QCVN	Viet Nam Regulation
WWTP	Wastewater treatment plants
PS	Pumping Station

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1. Project Background

1.1. Executive Summary of Project Background

Nha Trang is a coastal city in Khanh Hoa province, in distance of 1,280km from Hanoi Capital City to the Northand 448km from Ho Chi Minh City to the South. It is a political, economic, scientific –technological and tourist center of Khanh Hoa province in particular and the center of the Central - Western Highlands in general. The location of the city is shown in Figure 0-1 below.

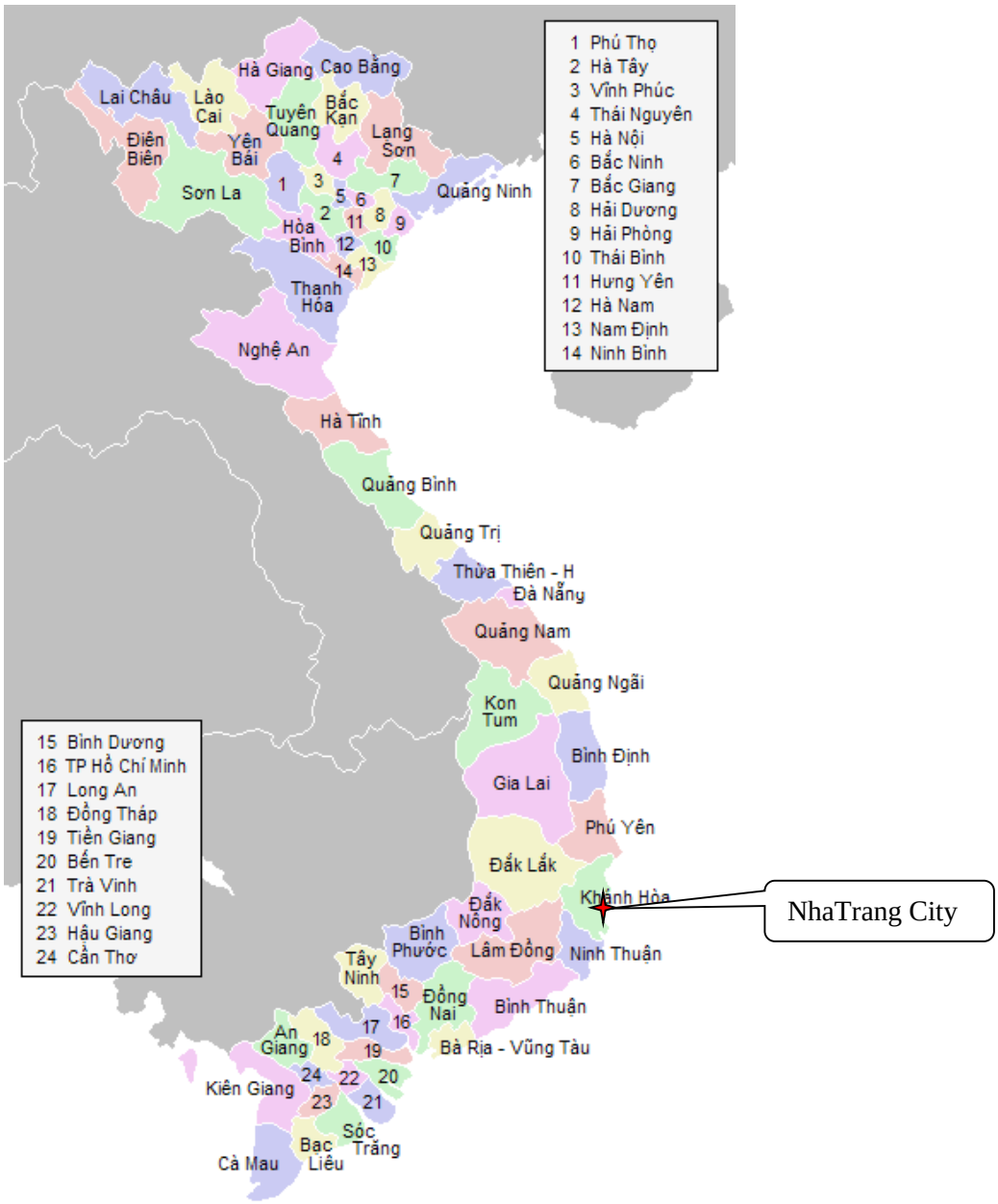

Figure 0-1. Location of NhaTrang city

From 2006 to 2014, Coastal Cities Environmental Sanitation Project (CCESP) financed by World Bank (WB) and the counterpart fund of the Government was implemented in the three

cities of Nha Trang (Khanh Hoa province), Dong Hoi (Quang Binh province), and Quy Nhon (Binh Dinh province). Nha Trang city Subproject had a total investment of USD 93.6 million with 6 components, including Component 1 on drainage, flood control and wastewater collection; Component 2 on wastewater treatment plant; Component 3 on solid waste management; Component 4 on resettlement and site clearance; Component 5 on revolving fund and school sanitation program; and Component 6 on capacity strengthening and project implementation support. The locations of the works items constructed under the CCESP are shown in Figure 0-2.

Figure 0-2. Locations of investment items of CCESP

In Nha Trang, due to limited fund and impact of high inflation in 2007-2009 period, CCESP was only implemented in the central and southern area of the city. After completion, the Project has brought considerable benefits to this area, including a substantial decrease in flooding and significant improvement in environmental sanitation conditions, reducing pollution at the discharge points because wastewater is collected to the Southern Wastewater Treatment Plant (WWTP) with a capacity of 40,000 m^3/day. The plant is operating stably, achieving parameters set forth in Column A of the national effluent wastewater quality standard. The Project has achieved the development objectives, improving environmental sanitation condition of the city in a sustainable manner, thereby improving living quality of residents.

Apart from the positive changes achieved, the Southern WWTP has not reached its full efficiency because the network of tertiary sewers in the central and southern area has not been fully completed. Elimination of some work items inthe northern area of the city from the original loan agreement of CCESP has resulted in flooding problem. Since the wastewater in the northern area has not been collected and treated, water environment, especially at the outlets to the sea on Pham Van Dong street and those along Cai river, is seriously polluted. Meanwhile, the northern area is under rapid urban development, social infrastructures such as schools, hospitals, and tourist service areas which have been constructed drastically quickly, resulting in an increase of severe water pollution in the area. Therefore, investment in the drainage system, wastewater collection and treatment in the northern area, construction of the embankments and roads at the two banks of Cai river, and completion of the tertiary sewer network in the central and southern areas, is critical to ensure sustainable development in the future.

To maintain the environmental investment efficiency and strengthen the institutional reform programs related to environmental sanitation of the participating cities, the Government of Vietnam has proposed to the World Bank to finance a new project, namely Coastal Cities Sustainable Environment Project (CCSEP) in the four coastal cities of NhaTrang, Dong Hoi, Quy Nhon, and Phan Rang - Thap Cham.

Lessons learnt as well as good practices on CCESP will be incorporated in the chapters of this ESIA.

1.2. Competent Agency Approving the FS Report

Competent agency approving the FS Report: Khanh Hoa Provincial People's Committee

1.3. Related Projects, Planning

1.3.1. Related Detailed Planning

a. Detailed planning on a scale of 1:500 of Nam Vinh Hai residential area

This planning is the Southern-west area of Vinh Hai ward, Nha Trang city with housing land of about 43.49%, 19% of public infrastructure, 13.22% of greenery and regulating lake and 24.29% of traffic land, respectively.

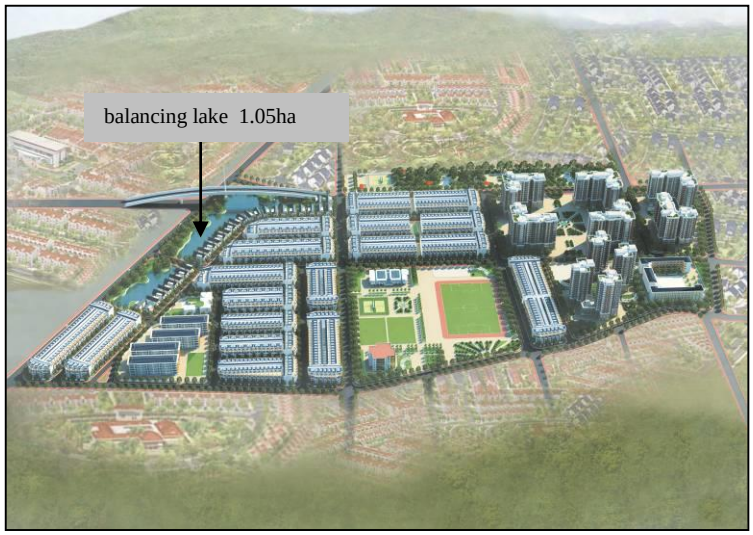

Figure 0-3. Detailed planning in scale of 1:500 of South Vinh Hai residential area

Location, area and functions of the balancing lake under the Project arein line with this planning.

b. Detailed planning in scale 1:2000 of Vinh Tho and Vinh Phuoc Wards, Nha Trang City, Khanh Hoa Province

This planning is for the residential areas of Vinh Tho-Vinh Phuoc wards over an area of about 212 ha. The designed leveling elevation for the area is more than 3.5 m. The construction areas are interspersed with residential areas, so the leveling elevation is determined in compliance with specific area to match elevation of adjacent structures.

The subproject would include construction of Chu Dong Tu Street inline with this planning.

Figure 0-4. Detailed construction planning for Vinh Tho-Vinh Phuoc Wards

1.3.2. Related Projects

a. Coastal Cities Environmental Sanitation Project (CCESP)-Nha Trang city Sub-project

The Nha Trang subproject is the continuation of the CCESP funded by WB which was implemented from 2006 to 2014 *to completely solve the flooding problem in the southern area and the water pollution in the northern area of the city for sustainable development in the futurewhile maintaining the environmental investment efficiency.* During implementation

of the CCESP in Nha Trang, the following lessons on environmental management and supervision are drawn up for the new proposed subproject:

(i) Project implementation phase

- *Fully promote the role of Construction Supervision Consultant (CSC) in supervising ESMP implementation*: During the implementation, CSC fulfilled their roles in regularly and continuously supervising implementation of the site environmental management plan by the contractors. Therefore, most of contractors basically took full measures for management and mitigation of negative environmental impacts.
- *The PMU closely coordinated with local authorities and people in the project area*. The PMU regularly communicated with and informed the locality and the people in the affected area of the project scope, progress and implementation period for their monitor and support on the project implementation. Favorable conditions were created for the local people to inform environmental issues to PMU via various communication channels such as direct reflection at PMU office, a hotline, and the website of the PMU, etc.
- *Community Environmental Monitoring Plan (CEMP) was well implemented*: During the project implementation, CEMP was always fully implemented to promote its effectiveness. Particularly, the People's Committees of wards/communes and local people in the project area were timely informed of the impacts of construction on the environment and society; closely coordinating with the PMU and Contractors to promptly handle arising incidents; supporting the PMU and Contractors in site clearance work and management of workers.
- *Good communication and provision of clear information on the subproject contents and construction schedule to the local authorities and conduction of public meetings before implementation were* essential for promoting effectiveness of the CEMP helping receive positive support from the local authorities and people.
- *Close coordination between PMU and the Independent Environmental and Social Monitoring Consultant was regularly maintained during implementation of the ESMP.*
- The PMU in coordination with Nha Trang Women's Union integrated subproject related activities into the initiatives of Healthy City Partnership Program; conducting communication activities to raise awareness on environmental sanitation and inform local people of the project benefits and wastewater connection in particular.
- *The PMU regularly coordinated with the Consultants to carry out evaluation of the environmental and social compliance of the Contractors.* The Contractors who adequately performed mitigation measures for environmental, traffic, and labor safety, such as the Contractors of Packages NT1.7, NT2.1, NT3.2A, NT3.4,were praised. Other contractors with not very good performance such as those of Packages NT1.5A and NT1.5B were timely reminded.
- *Thanks to constant attention of the related parties, risks and incidents arising during project implementation were minimized;* and once happened, they were all noted and timely and satisfactorily addressed:

  + Optical fiber cables was broken by Contractor of Package NT1.5A during the construction on Ly Nam De Street. The Contractor compensated in cash for the power management unit for proper remedy.

  + Cracks at houses near the construction site under Package NT1.5B were fully compensated. The Contractor proposed and constructed a temporary road to cover

exposed culverts on Road No. 22, facilitating local traffic and constructed temporary drainage ditches to drain the water during the rainy season.

- *Execution of works near sensitive areas such as schools, hospitals, markets, etc.* was implemented with effective mitigation measures including: (1) Prepare reasonable construction schedule, limit the construction activities during school time; limit construction activities near markets during rush hours; (2) accelerate the progress in order to reduce construction time; (3) apply adequate measures to mitigate dust, no stockpiling of all construction equipment at the same time in these sensitive areas and use canvas for areas close to sensitive works.
- *Methods for sewer construction integrated drainage methods for the existing areas* during construction. The mal odor generating from pumped water during construction possibly affected people living along the street could be mitigated by closed pipes to prevent water leakage, increasing number of pumps to shorten pumping time, and dredging old sewers and disposing dried and packed sludge to the accepted site immediately after the completion of each segment.
- *Countermeasures were used for landslide and the likely damages to the existing structures included Larsen sheet piles for upholding* where excavated trench is 5 m or deeper to control the risks during construction in soft soil foundation and on the roads close to households.

(ii) Operational phase

- At the South WWTP: the odor treatment during treatment process is crucial. The offensive odor was mainly generated from the influent and sludge treatment work. Mitigation measures have been applied, using closed odor treatment technology at the influent and sludge treatment works. Odor from these areas is collected and completely treated.
- School toilet area was designed and constructed with a more green, vivid, and attractive architecture to enhance pupils' awareness of environmental sanitation.

b. Infrastructure construction project for Ngoc Hiep resettlement area

The 14.63ha project resettlement area is under construction in Ngoc Hiep ward, Nha Trang city, Khanh Hoa province by the State budget with the total investment of 157,259,509,000VND. The investment scope includes the following work items: (1) Ground leveling, (2) Internal roads, (3) Drainage system, (4) Sewerage system (5) Water supply, (6) Electricity supply and lighting system, (7) Communication, (8) Greenery, (9) Traffic safety.

The construction period would be from 2016 to 2018. After completion, it is expected to provide 403 resettlement lots for the subproject.

c. Infrastructure construction project for Hon Ro 2 resettlement area

The project has the total investment of 128,517 billion VND financed by the State budget, building a resettlement area for the affected households. The resettlement site is located in Hon Ro 2 village, Phuoc Dong ward, NhaTrang city. The investment items for the site include (1) River embankment, (2) Internal roads and drainage system, (3) Water supply and lighting system, (4) Sewerage system. The resettlement site is 29.36ha and 5km away from the city center, providing 720land lots for resettlement and 48 lots for villas. Each resettlement lot is between 80-100 m^2. Construction of the infrastructure for 160 resettlement land lots was completed and handed over to the Provincial Land Fund Development Center to allocate on-site resettlement land for the affected households. As of March 2016, 50% of the resettlement site has been constructed. It is expected that construction of the whole site will be completed

for use in the fourth quarter of 2016. According to the data of NhaTrang Land Fund Development Center, 200 lots of this resettlement site will be reserved for relocation of the subproject affected households.

2. Legal and Technical Basis for ESIA Preparation

2.1. Related National Legal Documents

Administrative framework on Environmental Assessment

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

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

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.

- Environmental Protection Law No. 55/2014/QH13 ratified by the National Assembly of the Socialist Republic of Vietnam on June 23, 2014.
- Land Law No. 45/2013/QH13 dated 29 November 2013.
- Investment Law No. 67/2014/QH13 ratified by the National Assembly of the Socialist Republic of Vietnam on November 26, 2014.

- Construction Law No. 50/2014/ QH13 ratified by the National Assembly of the Socialist Republic of Vietnam on June 18, 2014.
- Law on Water Resources No. 17/2012/QH13 ratified by the National Assembly of the Socialist Republic of Vietnam on June 21, 2012.
- Law on Standards and Technical Regulations No. 68/2006/QH11 ratified by the National Assembly of the Socialist Republic of Vietnam on June 29, 2006.
- Decree No. 18/2015/ND-CP dated April 1, 2015 of the Government promulgating environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plan.
- Decree No. 19/2015/ND-CP dated 14 May 02, 2015 of the Government detailing the implementation of some articles of the Law on Environmental Protection.
- Decree No. 201/2013/ND-CP dated November 27, 2013 of the Government detailing the implementation of some articles of the Law on Water Resources.
- Decree No. 127/2007/ND-CP dated August 1, 2007 of the Government stipulating the implementation of some articles of the Law on Standards and Technical Regulations.
- Decree No. 80/2014/ND-CP dated August 6, 2014 of the Government stipulating drainage and waste water treatment.
- Decree No. 03/2015/ND-CP dated 06 May 2015 of the Government on the environmental damage assessment.
- Decree No. 59/2015/ND-CP dated June 18, 2015 of the Government on construction project management.
- Decree No. 38/2015/ND-CP dated April 24, 2015 of the Government on the management of waste and scrap.
- Decree No. 179/2013/ND-CP dated December 30, 2013 of the Government on sanctioning of administrative violations in the field of environmental protection.
- Decree No. 43/2014/ND-CP dated May 15, 2014 of the Government detailing the implementation of some articles of the Law on Land.
- Decree No. 44/2014/ND-CP dated May 15, 2014 of the Government regulating land prices.
- Decree No. 45/2014/ND-CP dated 05/15/2014 of the Government providing the collection of land use levy.
- Decree No. 46/2014/ND-CP dated 05/15/2014 of the Government providing the collection of land and water surface lease.
- Decree No. 47/2014/ND-CP dated 05/15/2014 of the Government regulating compensation, support and resettlement upon land acquisition by the State.
- Decree No. 84/2013/ND-CP of the Government on management of housing development and resettlement.
- Decree No. 16/2016/ND-CP dated 03/16/2016 of the Government on the management and use of official development assistance (ODA) and preferential loans from donors;

- Circular No. 27/2015/TT-BTNMT dated May 29, 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plan.
- Circular No. 36/2015/TT-BTNMT dated June 30, 2015 of the Ministry of Natural Resources and Environment on hazardous waste management.
- Circular No. 36/2014/TT-BTNMT dated 06/30/2014 of MONREonland pricing method; compilation of and adjustment to land price lists; determination of specific land prices and consultancy on land pricing.
- Circular No. 37/2014/TT-BTNMT 06/30/2014 MONRE detailing regulations on compensation, support, and resettlement upon land expropriation by the State.
- Decision No. 63/2015/QD-TTg of the Prime Minister dated 10/12/2015 on policy on assistance in vocational training and job search for workers whose land is acquired.
- Decision No. 1956/2009/QD-TTg of the Prime Minister dated 17/11/2009 approving the project on "Vocational training for rural workers by 2020".

Applicable standards and regulations:

- QCVN 05:2013/BTNMT: National Technical Regulation on Ambient Air Quality.
- QCVN 50:2013/BTNMT: National Technical Regulation on Hazardous Thresholds for Sludge from Water TreatmentProcess.
- QCVN 06:2009/BTNMT: Ambient air quality. Maximum allowable concentration of hazardous substances in ambient air.
- QCVN 26:2010/BTNMT: Acoustics – Noise in public areas and residential areas – Permissible noise levels.
- 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 03-MT:2015/BTNMT - National technical regulation on the allowable limits of heavy metals in the soils.
- QCVN19:2009/BTNMT – National Technical Regulations on industrial emissions for dust and inorganic substances.
- QCVN 20:2009/BTNMT – National Technical Regulation on Industrial Emission of Organic Substances.
- QCVN 07:2009/BTNMT- National Technical Regulation on Hazardous Waste Threshold
- QCVN 14:2008/BTNMT- National technical regulation on domestic wastewater.
- Viet Nam Building Code QCXDVN 01: 2008/BXD compiled by Vietnam Institute for Urban and Rural Planning, approved by Science and Technology Department, issued under Decision No. 04/2008/QD-BXD dated 3 April 2008 by the Ministry of Construction.

Legal project documents

- Letter No. 5664/UBND-XDNĐ dated 27 August 2015 of Khanh Hoa Provincial People's Committee on agreement on the construction locations of work items under CCSEP.

- Notice No. 426 /TB- UBND of Khanh Hoa Provincial People's Committee dated October 3, 2013 on Conclusions of the Provincial people's Committee after the meeting on the adjustment of construction site of the northern WWTP in Nha Trang City; Compensation, support and resettlement for the Duong De residential area project in Nha Trang city.
- Letter No. 4190/UBND-XDNĐ dated 15 July 2015 of KhanhHoa Provincial People's Committee on the adjustment of land use planning of DH2 lot in 1:2000 scale detailed planning of the Southern-west for of Hon Nghe, Vinh Ngoc commune, NhaTrang city.
- Pursuant to Notice No. 507/TB-UBND dated 15 September 2014 of Khanh Hoa Provincial People's Committee on "Conclusions of the Provincial people's Committee on solving some problems related to Nha Trang city Environmental Sanitation Improvement Project".
- Decision No. 2793/QD-UBND dated 11 June 2012 on approving Environmental impact assessment report of "Technical infrastructure construction for Hon Ro 2 resettlement area" project in Phuoc Dong commune, Nha Trang city, Khanh Hoa province.
- Decision No. 746/QD-UBND dated 25 March 2016 on approving Environmental impact assessment report of "Technical infrastructure construction for Ngoc Hiep resettlement area" project in Ngoc Hiep ward , NhaTrang city, Khanh Hoa province.

2.2. World Bank's Social and Environmental 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); and Involuntary Resettlement (OP/BP 4.12)[3] 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 CCSEP 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 A because of its potential significant adverse environmental and social impacts.

World Bank Group Environmental, Health, and Safety Guidelines[4]

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

[1]Full treatment of OP/BP 4.01 can be found at the Bank website: http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543912~menuPK:1286357~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html
[2]Full description of OP/BP 4.04 is available at http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543920~menuPK:1286576~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html
[3]Detailed description of OP/BP 4.12 is available at the Bank website:http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,contentMDK:20543978~menuPK:1286647~pagePK:64168445~piPK:64168309~theSitePK:584435,00.html
[4]The EHS Guidelines can be consulted at www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines.

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

2.3. Documents and Data Prepared by the Employer

The documents and data created by the Employer include: Project Feasibility Study and Basic Design Documents; Resettlement Action Plan; Social Assessment; Environmental Impact Assessment of work items approved under the CCESP that have not been implemented and will be implemented under this subproject.

3. EIA Implementation Arrangement

The Consultant for ESIA is Vietnam Water, Sanitation and Environment Joint Stock Company. During the assessment of environmental and social impacts, the Consultant has closely coordinated with the Employer– Khanh Hoa Development Project Management Unit.

The Consultant: Vietnam Water, Sanitation and Environment Joint Stock Company

Legal representative: Mr. Le Van Tuan - General Director

Contact address: No. 5, Duong Thanh, Cua Dong Ward, Hoan Kiem District, Hanoi

Tel: 043 828 1429 / Fax: 043 828 4760

Key experts participating in preparation of the ESIA are listed below (table 0-1):

Table 0-1. Key Experts for ESIA Report Implementation Arrangement

NO.	Name of experts	Qualification	Tasks
1	Dao Thanh Thai	Master of sociology	Team leader/ Senior environmental or/and social specialist
2	Le Hung Anh	Ph.D	Environmental Specialist
3	Do Huu Thu	Ph.D of Biology	Ecology Specialist
4	Tran Hoai Le	Environmental engineer	Environmental Modeling Specialist
5	Nguyen Nhu Tung	Bachelor of chemistry	Chemical/Analysis Specialist
6	Nguyen Le Tam	Bachelor of sociology	Resettlement Specialist 1
7	Quang Thu Nguyet	Master of sustainable development	Social / Community Specialist 1
8	Pham Duc Nghiem	Bachelor of sociology	Social / Community Specialist 2

4. Environmental and Social Assessment Methods

This ESIA was prepared in parallel with the subproject feasibility study to identify and assess impacts and propose plans to prevent, mitigate and control potential negative environmental and social impacts potentially occurring during subproject implementation. Environmental-friendly solutions towards sustainable development are also considered during the preparation and implementation of the subproject. The ESIA is developed in compliance with the safeguard policies of the WB and the related national laws and regulations.

a). Rapid assessment method

The Rapid Assessment Method was issued by the World Health Organization (WHO) in 1993. Basis of this method is nature of materials, technologies and rules of natural processes as well as experiences in rating pollution load.

In Vietnam, this method is introduced and applied in many ESIA studies, performing the relatively accurate calculation of the pollution load in the context of limited measurement and analysis instruments. In this report, the pollution load coefficients are taken under the ESIA guidelines of the World Bank (Environmental Assessment Sourcebook, Volume II, Sectoral Guidelines, Environment, World Bank, Washington D.C 8/1991) and Handbook of Emission, Non-Industrial and Industrial source, Netherlands).

b). Impact matrix method

Building correlation between effects of each subproject activity to each issue and environmental composition is as shown in the impact matrix. On such basis, detailed contents to be studied with impacts will be oriented.

c). Comparison method

The comparison method is to assess the environmental quality, effluent quality, pollution load, etc. On the basis of comparison with the concerning environment norms and standards, the regulations of the Ministry of Health as well as the related researches and experiments.

d). Impact identification method

This method is applied through the following specific steps: describe the environment system; identify the subproject components that affect the environment; and identify the full range of related waste streams, environmental issues to serve the detailed evaluation.

e). Listing method

It is used quite common (since the establishment of the National Environmental Protection Agencies in some countries - NEPA) and bring positive results thank to many advantages as clear approach, systematic provision during system analysis and evaluation. It includes 2 main categories: The description listing table which lists the environment components in need of research in addition to the information on the measurement, prediction and evaluation; and Simple checklist which will list environmental components to be studied and likely to be affected.

f). Method of 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.

Other Methods

a). Method of information and data inheritance, summary and analysis

This method is to identify and assess natural conditions and socio-economic conditions of the subproject area through data and information collected from various sources such as the statistic yearbooks, regional socio-economic profile reports, and regional baseline environmental and relevant studies. At the same time, the inheritance of the available studies and reports is really essential to use up available findings and further identify limitations.

b). Field survey method

Field survey is compulsory for ESIA to identify the status of the subproject area, relevant surrounding objects to select sampling positions, survey of status of natural environment, hydrography, weather conditions, land use, vegetation cover, fauna and flora in the subproject area. These survey results will be used for assessment of natural conditions of the subproject area.

c). Consensus method

Based on knowledge and experiences in environmental science of ESIA, the specialists of the consultant team and other scientific research units with in the consulting firm will discuss and agree the fidings of the ESIA.

d). Sampling and analyzing methods in laboratory

Sampling and analyzing samples of environmental components (soil, water, air) are integral to identify and evaluate status of baseline environment quality in the subproject area.

e). Social survey and assessment method

Social survey and assessment method: From the list of households living in the study area selected and the list of affected households by each investment item, socio-economic survey was carried out in 3 weeks from February 18 to February 29 with 843 households in 18 wards/communes in Nha Trang City. Answers from the sociological survey using questionnaires were processed using SPSS software (Statistical Package for Social Sciences).

In-depth interviews were carried out with 54 key informants: leaders of the Province/City/Ward People's Committee; officers of provincial department of economy/construction planning/land use planning; officers of City Infrastructure Department, leaders/deputy leaders of village/street groups at ward/commune level, households in project area (including affected households and beneficiary households)

12 group discussions were conducted for the 105 affected households in Vinh Hai, Vinh Tho, Vinh Phuoc, Ngoc Hiep, Van Thang and Vinh Ngoc wards with from 6 to 10 persons for each discussion group.

f). Monitoring method

Monitoring is applied to collect and analyze water samples (wastewater, surface water, groundwater); air, noise, vibration, and mud/soil samples. Environmental monitoring processes are carried out according to Vietnamese regulations to assess the current status of the environment of the project area.

g). Comparison method

Comparison is used to assess impacts and current status of environment by comparing environmental monitoring data and collected data with Vietnamese standards and regulations, comparing options.

CHAPTER 1. SUBPROJECT DESCRIPTION

1.1. General Description of Subproject

1.1.1. General Description

Project Title: Coastal Cities Sustainable Environment Project (CCSEP) – NhaTrang City subproject

Employer: Khanh Hoa Development Project Management Unit

The Employer's Representative: Mr. Chau Ngo Anh Nhan – Position: Director of Project Management Unit.

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Subproject Development Objectives

The overall objectives of the subproject are to ensure effective sustainability of the investments in the environment and to strengthen the institutional reform program related to environmental sanitation of the city.

The specific objectives of the subproject are to: (a) improve the operational capacity of the Southern WWTP through an additional investment in completing the tertiary sewer network and odor prevention manholes in the central and southern areas of the city, (b) resolve the flooding and pollution problems in the northern area of the city through construction of combined and separate wastewater collection sewers, odor prevention manholes, pumping stations, balancing lake, and the Northern WWTP, (c) improve environmental sanitation and enhance flood drainage and erosion control at the two banks of Cai river in combination with upgrading of the city transport infrastructure to meet the city development needs as planned, (d) to support performance of the project through consultancy services for contract management, construction supervision, environmental monitoring, social safeguard, independent auditing, etc. in accordance with regulations and requirements of the Government and WB. Technical assistance will be provided to the Employer, management agencies, and sectoral institutional reforms to achieve the targeted objectives during implementation for effective operation and sustainability of the subproject.

1.1.2 Geographical Location of the Subproject

The subproject will be implemented in the northern area of the city, covering over 04wards of Vinh Hoa, Vinh Hai, Vinh Phuoc, Vinh Tho and the suburban commune of Vinh Ngoc; the central area of the city covering the Ngoc Hiep and Van Thang wards; and 11 southern wards of the city including Loc Tho, Phuoc Long, Phuoc Hoa, Xuong Huan, Van Thanh, Phuoc Tien, Phuoc Tan, Phuong Sai, Phuong Son, Vinh Nguyen, and Tan Lap.

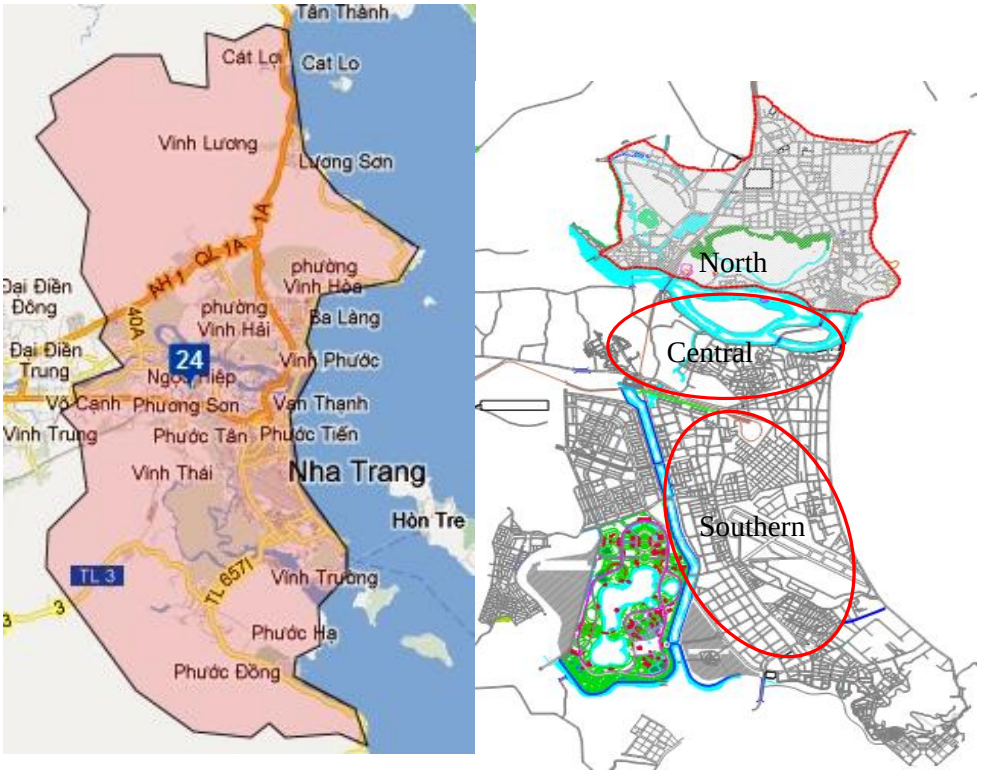


Figure 1-1. Subproject Location

1.2. Main Content of the Subproject

The subproject consists of 04components: Component 1 - Sanitation Infrastructure; Component 2 - Environmental Infrastructure; Component 3 - Resettlement and Site Clearance; and Component 4 - Technical Assistance and Institutional Reform.

Table 1-1.Summary of component investments

Work Item	Main specifications	Construction location
Component 1: Sanitation Infrastructure		
Installation of tertiary sewer[5]	Pipe uPVC, diameters of D150-D200-D300mm Total length: 94.6km	Loc Tho, Phuoc Long, Phuoc Hoa, Xuong Huan, Van Thanh, Phuoc Tien, Phuoc Tan, Phuong Sai - Van Thang, Phuong Son, Vinh Nguyen, Tan Lap.
Installation of combined sewers	Combined sewer, diameter of D600-D1000 Box culverts in diameter of 1x1 to 3x3x2,5 (m) Total length 6,786 m	Wards of Vinh Phuoc, Vinh Tho, Vinh Hai
Construction of wastewater pumping station (WWPS) and Combined sewer overflow (CSO) systems	Area of 04 WWPSs (PS1 - PS4): 45 m^2Area of pump station 5 (PS5): 1,650m^2	Wards of Vinh Hoa, Vinh Tho, Vinh Phuoc
Construction of drainage pumping station	Total land area: 1.29 ha	Vinh Ngoc Commune
Construction of sewers	Sewers, in dia. D90-D800	

[5]Wastewater collection sewer from household to primary and secondary sewer network

	Total length: 11,005m	
Construction of WWTP	Capacity of 15,000 m^3/day. Effluent satisfactory to QCVN 40:2011/BTNMT Column A Total land area: 3.03 ha	Vinh Ngoc Commune
Construction of the regulating lake	Area of 1.05 ha, depth of 4.5 m with sidewalk of 1.5m wide, lighting and green trees	Vinh Hai Ward
Construction of school sanitation blocks	School sanitation blocks for 04 schools with separated male and female restrooms.	Nguyen Khuyen, Ngo Van So, Dien Bien Phu, Ton That Tung streets
Component 2: Environmental Infrastructure		
Construction of embankment at the northern bank of Cai river	Length: 423m, accompanied with vegetation as landscape	VinhPhuoc Ward
Construction of road and embankment at the southern bank of Cai river bank	Embankment: 2,026m long Road: 2,064m long, 28m wide	Ngoc Hiep, Van Thang wards
Construction of Chu Dong Tu street	Length: 321m 14m wide Sewer, dia. D1500mmin length of 251m, box culvert 2x1.5 (m) in length of 78m, accompanied lighting system, greenery	VinhPhuoc ward
Construction of Road No. 4	Length: 1,828m, 17-8.5m wide ,accompanied drainage, sewerage, lighting system, greenery	VinhHai ward
Component 3: Resettlement and Site Clearance		
(no work items to be constructed under this Subproject)	The subproject will not build a separated resettlement site, but will resettle the affected households in the available resettlement sites of the city, which are Ngoc Hiep, Hon Ro 2, and Dat Lanh resettlement sites	
Component 4: Technical Assistance and Institutional Reform		
(including consulting services)	- Technical assistance for the Employer, the management agencies through independent consulting services, seminars, experience sharing, and periodical review workshops during implementation progress, and development of managerial procedures. - Support for sectorial institutional reform to promote efficiency during the operation and ensure the sustainability of the projects as well as experience sharing with other localities on ODA project management of drainage, and environmental sanitation. - Subproject management of the Employer and control activities of implementation process in compliance with regulations of the Government and the community-based media program to disclose information, raise awareness on environmental protection for the people in the subproject area	

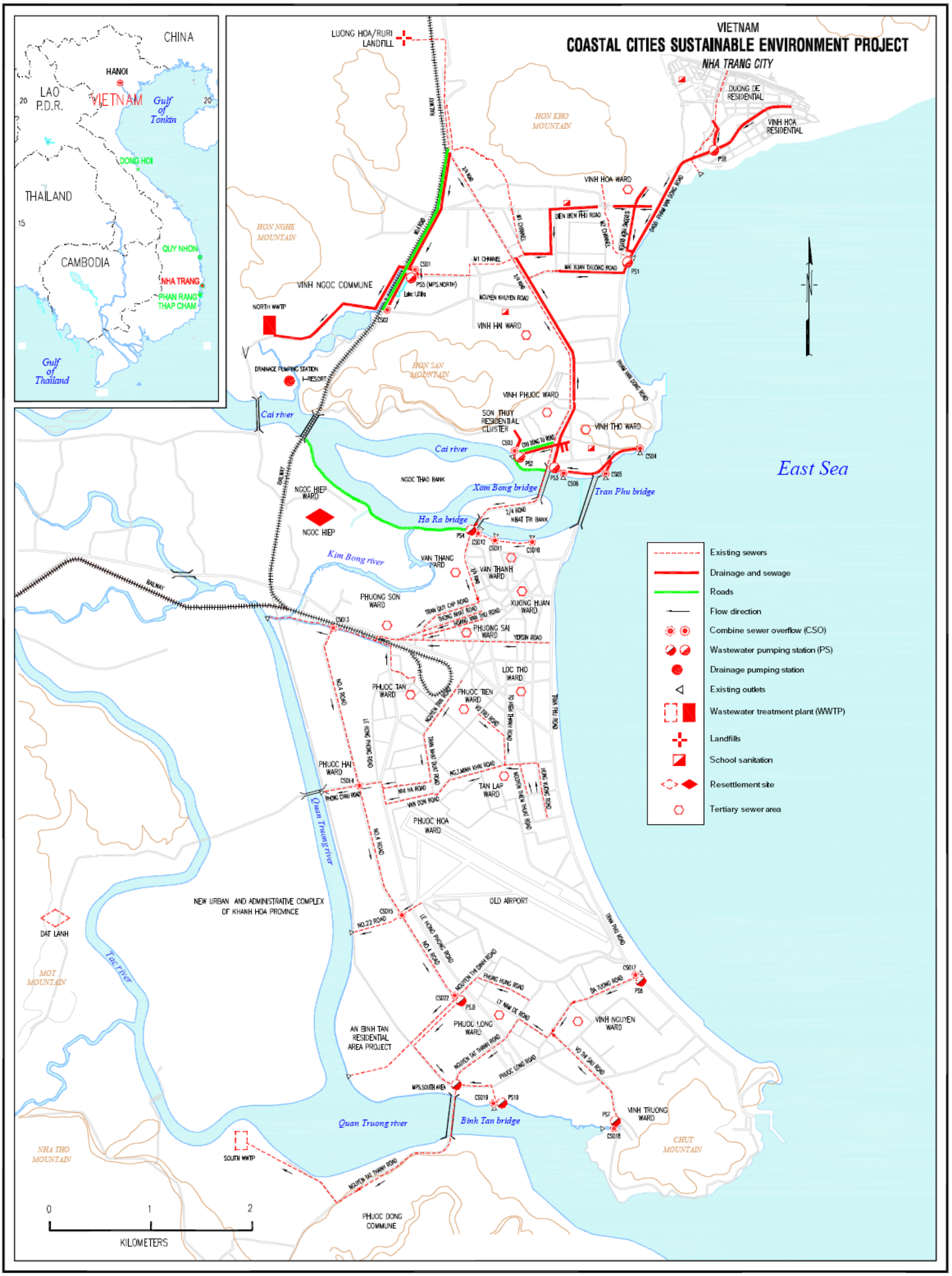


Figure 1-2. Locations of investment items

1.2.1.Component 1

The work items of Component 1 are described in details below:

(1) Installation of tertiary sewers D150, D200 and D300mm (uPVC) in the north, central, and south of the city:

A total of 94.6km of tertiary sewers in diameters varying from 150mm – 300mm (D150-D200-D300) and 5,370 manholes would be installed, in which 20.6km of sewerD300, 24km of sewerD200, 50km of sewerD150, and the manholes of 400x400x400 mm would be installed in 12 wards in the central and southern areas of the city, which are LocTho, Phuoc Long, Phuoc Hoa, Xuong Huan, Van Thanh, Phuoc Tien, Tan Phuoc, Phuong Sai - Van Thang, Phuong Son, Vinh Nguyen, Tan Lap and densely populated residential areas in the north including Duong De, AT, Son Thuy, and the residential areas with a dense population from Dang Tat street, April 2 street, Pham Van Dong street, Mai Xuan Thuong street. Tertiary sewers and wastewater connection boxes (one box per house or 2 houses subject to actual site condition), along the roads would be installed. Connections from the households, restaurants, and hotels to the connection boxes would be conducted by the respective owners.

According to VIWASE's survey, 8,000 households, 110 hotels, and 7 restaurants would be further connected to the wastewater collection system in the central and southern areas of the city, and 8,212 households, 42 hotels, and 32 restaurants would also to be connected in the northern area as well.

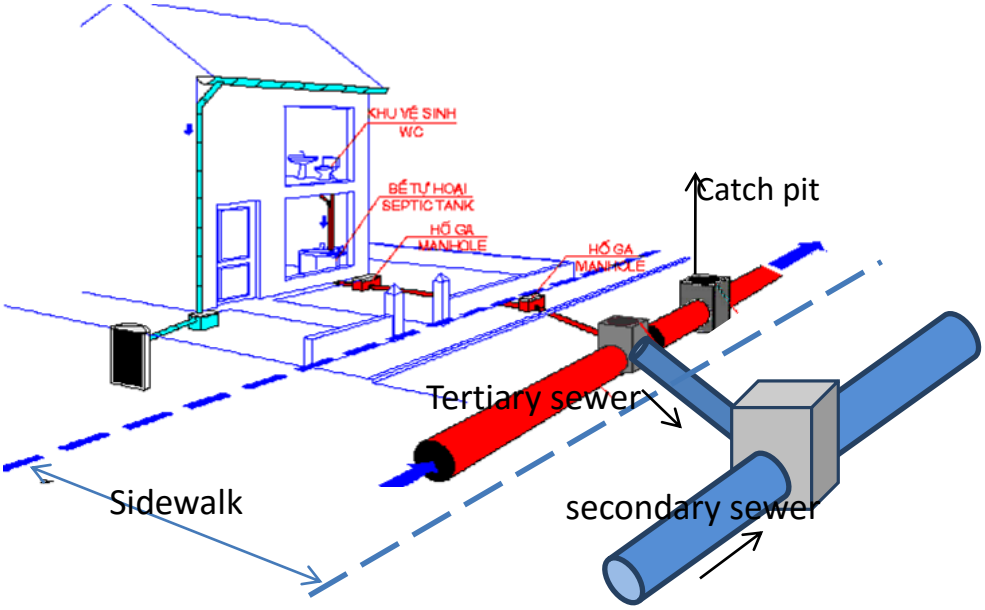


Figure 1-3. Diagram of house connection to tertiary sewer network

(2) Combined sewerage system in northern area:

In order to improve combined sewerage system in the north of the city, the subproject would install 6,786m of sewers in diameter varying from 600mm to 1,000mm and box culverts in dimension from 1x1 m to 3x3x2.5 m as follows (table 1-2):

Table 1-2.Combined sewerage system

No.	Location	Dimensions (mm)	Cover depth	Unit	Length
1	Sewer on April 2 street from Doan Tran Nghiep street to M1 Channel	1,0x1,0 1,2x1,2	1.7-2.48 1.72-2.39	m m	304 435

		2.0x1.5 2.5x1.5 2x(2.0x1.5) 2x(2,5x1,5)	2.01-2.38 2.04-2.38 2.18-2.31 2.18-2.31	m m m m	120 210 310 308
	Total				1,687
2	Sewer on Road from Thap Ba street to Nguyen Dinh Chieu street(on both sides)	D600 D800	1.3-1.55 1.5-1.83	m m	364 1,022
	Total				1,386
3	Sewer in area of Bau Market – Vinh Tho Ward	D600 D1000	1.4-1.8 2.09-2.17	m m	290 85
	Total				375
4	Culvert in Son Thuy Cluster	1.5x1.5	1.3-1.55	m	148
5	Construction of box culvert along with railway, to be laid underneath Road No.4- VinhHai Ward	2x2.5x2.0 2x2.5x2.5 3x3.0x2.5	2.8-3.88 3.21-3.6 3.3-3.79	m m m	303 618 418
	Total				1,339
6	Sewer on Dien Bien Phu street	D1000	1.1-1.89	m	900
7	Construction of box culvert connecting M1 Channel to balancing lake in the west of Vinh Hai Ward	4x(2x2.5) 15m	2.8-3.88 4	m	120 572
	Total				692
8	Box culvert from balancing lake to railway bridge	2x(2,5x2,5)	4-4.12	m	72
9	Construction of box culvert connecting Nguyen Khuyen Outlet to 1.05ha balancing lake	2x(2x2)m	4-4.12	m	187
TOTAL				m	6,786

(3) Combined sewer overflows:

Six combined sewer overflows would be constructed with the dimensions and locations shown in the following Table 1-3:

Table 1-3. Location and dimension of the combined sewer overflows

TT	Pumping station	Location	Dimension (length*width*height)
1	Wastewater combined sewer overflows 1 (CSO1)	At the end of box culvert of M1 Channel	3.3*1.1*4.44
2	Wastewater combined sewer overflows2 (CSO2)	Outlet at the end of Nguyen Khuyen street	4.2*2.0*4.1
3	Wastewater combined sewer overflows3 (CSO3)	Existing channel next to Son Thuy Shipyard	4.05*2.8*3.36
4	Wastewater combined sewer overflows4 (CSO4)	The beginning end of Pham Van Dong street, opposite Ton Than Tung street	3.05*2.5*2.46
5	Wastewater combined sewer overflows5 (CSO5)	Near Tran Phu Bridge	5.25*2.7*2.57

TT	Pumping station	Location	Dimension (length*width*height)
6	Wastewater combined sewer overflows6 (CSO6)	Road along the embankment of Cai River, opposite to Tran Kim Hung street	3.8*1.9*2.92

(4) Wastewater pumping stations:

The subproject would build 4 intermediate wastewater pumping stations and 1 main wastewater pumping station with submersible pumps in reinforced concrete pumping chambers.

Table 1-4. Location and capacity of wastewater pumping stations (WWPS)

No.	Name of WWPS	Location	Capacity (m^3/d)	Area (m^2) (depth)
1	PS1	Sidewalk of Pham Van Dong street toward Mai Xuan Thuong street is about 4m away from the existing box culvert (M2 Channel)	1,839	BxH=5x9 4.63min depth
2	PS2	Vacant land at the foot of Xom Bong Bridge (to the East of the Bridge)	2,820	BxH=5x9 5.53min depth
3	PS3	Planned sidewalk of intersection of Cai river embankment road and Chu Dong Tu street	873	BxH=5x9 6.85m in depth
4	PS4	Sidewalk of Than Nhan Trung street, 25m away from intersection of Pham Van Dong street	1,378	BxH=5x9 5.8m in depth
5	PS5-Main pumping station	Land lot X7 (green planning area in accordance with detailed planning at scale of 1/2000 for Vinh Hai-Vinh Hoa ward residential area)	14,287	BxH=50x33 8.76m in depth

(5) Odor Prevention Manholes:

509 inlets would be replaced with odor prevention manholes. Dimension of each inlet is 400x400x400 (mm) on the main roads: Dien Bien Phu street, Dang Tat street, Bac Son street, Cu Chi street, Pham Van Dong street, and April 2 street in the North.

(6) Drainage pumping station:

The drainage pumping station wouldbe located at downstream of the existing channel to Cai River in Land Lot D5 of the detailed planning at scale1:2000 of southwestern Hon Nghe. The pumping station borders the planned road of Nha Trang I-resort to the West and East with the elevation of the road at +3.50m, and vacant lands to the North and South.

This pumping station would solve flooding for the northern area of the city, such as the streets of Dien Bien Phu, Nguyen Khuyen, April 2 street.

By2021, the subproject would construct the drainage pumping station with a capacity of $10m^3$/s equipped with 03 pumps (2 operating pumps and1 standby pump) with a capacity of $5m^3$/s, H=4m each. The civil works would include a chamber, a discharge channel, a pump house, and a discharge channel meeting a discharging capacity of $40m^3$/s, in consistence with the urban development plan in the future. The pumping station would be located on an area of 1.29ha.

Figure 1-4. Location of the drainage pumping station

(7) Sewers :

Table 1-5. Sewers

	Sewers	**Diameter (mm)**	**Cover Depth (m)**	**Length (m)**
1	Pham Van Dong street (Duong De residential area) - gravity sewer	D300	1.0-4.05	1,046
2	Road in Duong De residential area - gravity sewer	D300	2.94-3.76	314.6
3	Pham Van Dong street– pressure pipe from PS4 (Duong De residential area) to gravity sewer	D200	1-1.59	924
4	Dien Bien Phu street - gravity sewer	D400	1.1-1.89	383
5	Duong Hien Quyen street - gravity sewer	D400	1.2-2.78	863
6	Pham Van Dong street (Dien Bien Phu intersection to PS1)	D400	1.2-2.2	431
7	Gravity sewer on Road No. 4	D300	1.5-2.0	1,209
8	Pressure pipe from PS1 to combined sewer on Mai Xuan Thuong street	D200	0.92-1.6	749
9	Pressure pipe from PS3 to April 2 street (Doan Tran Nghiep intersection), then running along April 2 street	D200	0.91-3.3	808

10	Pressure pipe from PS2 in Son Thuy Cluster to April 2 street	D200	0.96-1.0	871
11	Sewer on Pham Van Dong street from CSO4 to the river embankment road	D300	2.46-4.04	380
12	Sewer on Pham Van Dong street from CSO5 to the river embankment road	D300	2.57-3.03	129
13	Sewer on the river embankment road from Pham Van Dong street to PS3	D300	3.35-4.15	517
14	Sewer from CSO2 to PS5 – Vinh Hai Ward	D400	4.25-5.79	534
15	Sewer from CSO1 to PS5 – Vinh Hai Ward	D800	4.34-6.26	76
16	Pressure pipe from PS5 to WWTP – Vinh Hai Ward, Vinh Ngoc Commune	D700	1.37-1.6	1,773
17	Pressure pipe from April 2 street to Road no. 4	D90		37
	Total			11,005.6

(8) Northern Wastewater Treatment Plant:

The Northern WWTP serving the entire northern area of the city would be located in Vinh Ngoc commune – Nha Trang City, on an area of 3.03 ha. The current site is vacant land, about 100-300m away from the sparsely populated residential area. This location is consistent to the approved detailed planning at scale 1:2000 of the southern Hon Nghe. The capacity of the WWTP would be 15,000m^3/day, divided into 2 modules with 7,500m^3/day each, using the oxidation ditch technology. The WWTP effluent would comply with the National Technical Regulation on Industrial Wastewater, QCVN 40:2011/BTNMT column A, meeting water quality for water supply with the main parameters shown in Table 1-6.

Table 1-6.Main parameters of the effluent quality

No.	***Parameter***	***Unit***	***Influent data***	***Effluent data***	***QCVN 40:2011/BTNMT column A***
1	pH	-	-	6-7	6 - 9
2	COD	mg/l	270	<50	75
3	BOD_5 (20 ^{0}C)	mg/l	150	<10	30
4	Total suspended solid (TSS)	mg/l	160	<20	50
5	Ammonia (by N)	mg/l	23	<3	5
6	T- N	mg/l	30	<10	20
7	Phosphate (by P)	mg/l	7	<4	4
8	Total Coliforms	mg/l	-	<3,000	3,000

The effluent would be discharged to the canal next to the WWTP and then to Cai River. The canal is about 1km long, while the discharging section to Cai river would be about 650-700m. The distance from the receiving point on Cai river to the river estuary is about 4.5km. The canal is about 6-12m wide and 1m deep.

The current elevation of the area varies from -0.8 to +5.0m, while the designed elevation is +3.8m.After completion of site leveling for the WWTP area to +3.5m, the elevation of the area would be approximate 4,5m.

The WWTP would comply with the National Building Code on Urban Engineering Infrastructures QCVN 07:2010/BXD, requiring a buffer zone of 30 m from the fence of a WWTP using biological treatment technology with sludge treatment by mechanic equipment in combination with odor collection and without sludge drying beds. This technology has been successfully applied in the Southern WWTP, and its offensive odor is negligible.

Trees would be planted within the open spaces and surrounding the fence of the WWTP to create a green landscape and limit odor if any. The greening belt would be 3m wide from the fence and 30m wide from the residential area on the west side of the WWTP. The WWTP's lay-out is presented in the Figure 1-5.

Figure 1-5. Plan of the WWTP and the buffer zone

Investment quantities of the WWTP are presented in Table 1-7.

Table 1-7.Quantities of WWTP

NO.	Items	No. of module	Mass flow of each tank	Diameter	Length	Width	Height	Water depth	Effective volume of each tank
				for each tank					
			m^3/h	m	m	m	m	m	m^3
1	Influent distributing channel	1	1,606		3.0	3.0	5.70	4.90	44
2	Coarse screener ditch	2	1,606			1.0			
3	Fine screener ditch	2	1,606			1.5			
4	Air-scouring sand and grease removal tank	2	803		20.0	2.9	3.10	2.38	127

NO.	Items	No. of module	Mass flow of each tank	Diameter	Length	Width	Height	Water depth	Effective volume of each tank
			for each tank						
			m^3/h	m	m	m	m	m	m^3
5	Discharge ditch of air-scouring sand and grease removal tank	1	1,606		1.2	4.1	5.00	4.20	21
6	By-pass channel	1	641		1.2	4.1	5.30	4.20	21
7	Distribution chamber	2	965		4.7	2.0	5.90	5.10	48
8	Anoxic tank	2	1,930		11.0	11.0	5.90	5.00	605
9	Oxidation ditch	2	965		36.6	17.6	5.90	5.00	2,887
10	Final sedimentation tank	2	965	25.0			4.46	3.90	
11	Disinfection tank	1	965		14.2	9.0	5.97	3.70	473
12	Effluent flow measuring chamber	1	965		1.5	4.0	2.90	2.27	14
13	Outlet channel to river	1	1,606		190.0	1.0	1.00	1.00	190
14	Excess/recycled activated sludge pumping station	2	965		6.6	3.5	6.35	5.85	135
15	Septic sludge receiving tank	1	28		10.0	5.6	2.20	1.75	75
16	Gravity thickener	2	20	9.0			4.20	3.60	207
17	Sludge storage tank	1	20		8.7	5.0	4.10	3.60	157
18	Foam collecting tank	1	55		9.0	6.0	4.10	3.60	194
19	Potable water reservoir	1	70		6.0	6.0	2.80	2.10	76

The Northern WWTP is an item under CCESP but it has not been implemented due to shortage of investment fund. The CCESP ESIA, which includes the Northern WWTP, was approved by Khanh Hoa People Committee and the World Bank. The WWTP was proposed to be constructed with a capacity of 14,000m^3/day for Phase 1 and to be upgraded to 21,000m^3/day in Phase 2. Under the subproject, the Northern WWTP is proposed to be of a capacity of 15,000m^3/day with the same treatment technology proposed under the CCESP.

The treatment capacity of the WWTP has been calculated for meeting the city wastewater treatment need till 2025, with a beneficiary population of 131,459 persons (in which the populations of the urban and suburban areas which are about 92,806 persons and 18,653, respectively, and a number of visitors of about 20,000 persons). The rates of wastewater collection in the urban and suburban areas are 80% and 20%, respectively. The volume of average wastewater collection in one day is about 11,000 m^3, in which the volume of the average wastewater collection in public area is about 2,200 m^3. The volume of sludge arising from the WWTP would be about 2.3 tons per day. The collected wastewater is mainly domestic wastewater; therefore, the sludge arising from the WWTP would not expected to contain heavy metals and hazardous substances.

The WWTP will collect untreated wastewater from residential areas such as Vinh Hai, Vinh Phuoc and Vinh Tho ward, Duong De residential area, Vinh Hoa urban area, residential area near Ba Lang discharge gate before discharging into environment. The wastewater collection scope of the WWTP is presented in the Figure 1-6.

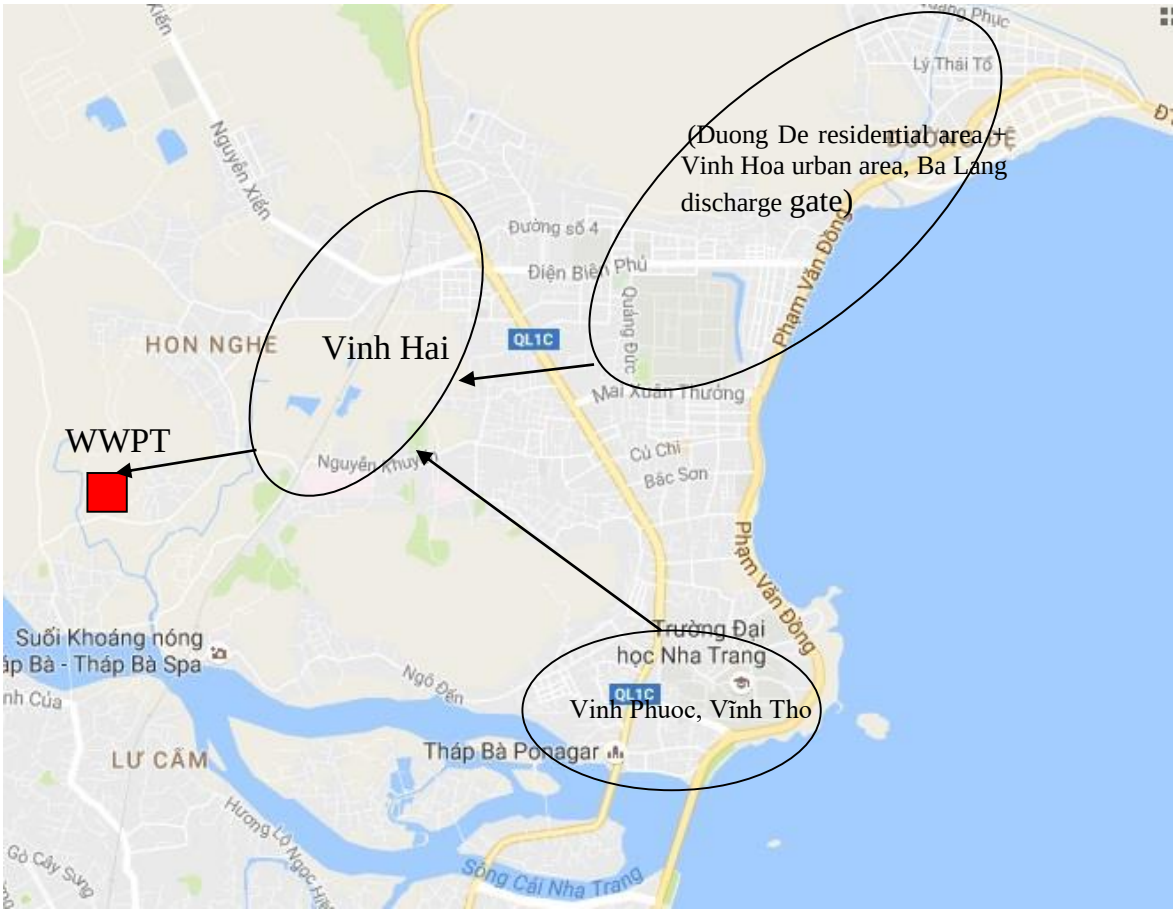


Figure 1-6. Wastewater collection areas

(9) Regulating lake

The regulating lake would be located in the north of Vinh Hai ward on an area of approximate 1.05ha with 4.5m in depth. The embankment structure from invert elevation -1.0m to normal water level +1.0m would be constructed with rock revetment. The slope from normal water level to embankment top would be designed with concrete squares for grass seeding. A green belt of 2.6m wide would be constructed right next to the embankment with a 1.5m wide footpath. Six maintenance stairs accessible to the lake for maintenance and dredging would also be constructed.

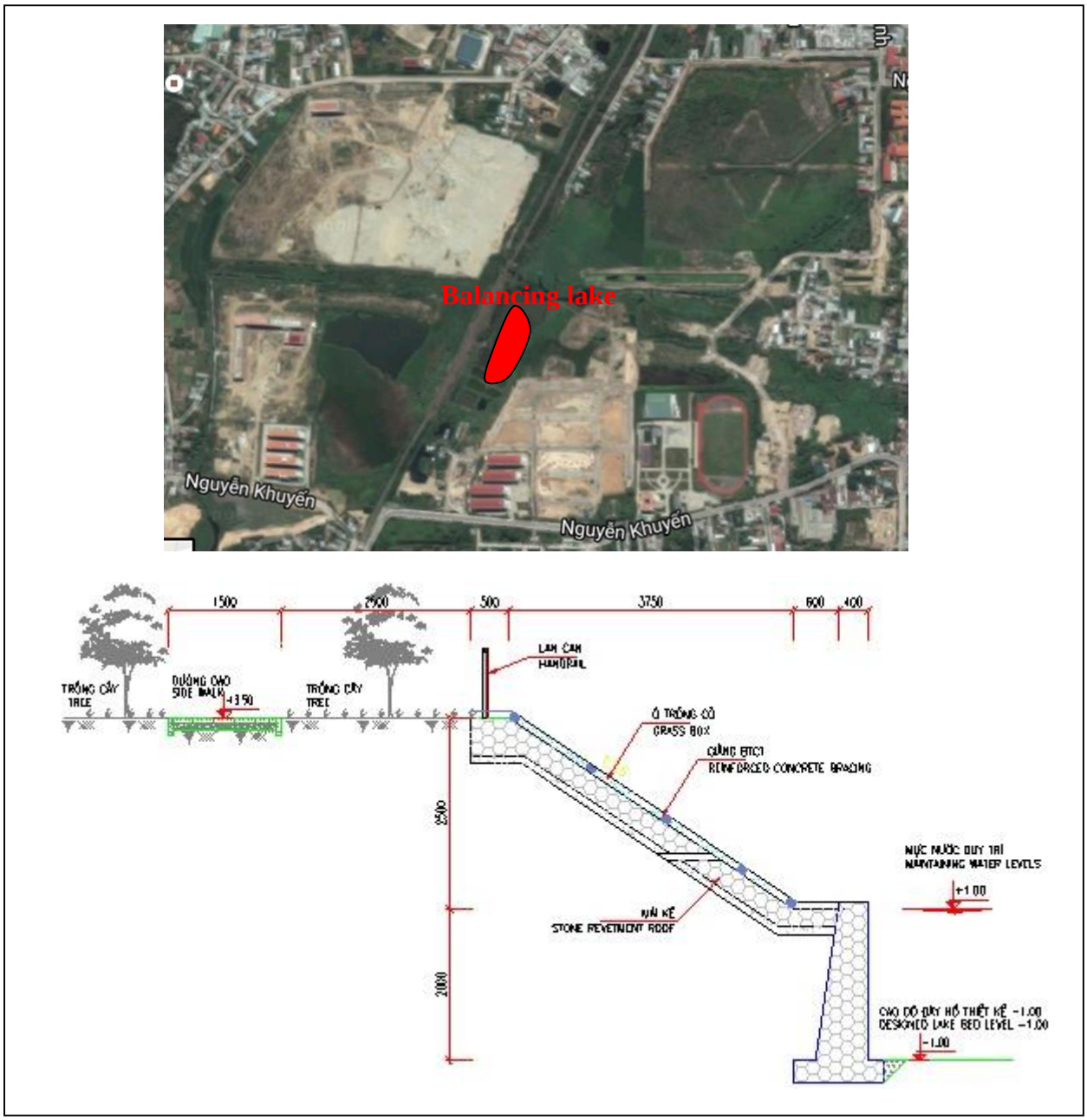


Figure 1-7. Plan and cross section of the designed lake

School sanitation: Four new rest rooms would be constructed in the four primary schools below:

- Vinh Hai Primary school No. 2 on Nguyen Khuyen Street: A 72 square meter rest room for 400 school children.
- Vinh Hoa Primary school No. 2 on Ngo Van So Street: A 90 square rest room for 400school children.
- Vinh Hoa Primary school No. 1 on Dien Bien Phu Street: A 90 square meter rest room for 1,050 school chidren.
- Vinh Tho Primary School on Ton That Tung Street: A 50 square meter rest room for 800school children.

Pursuant to the national technical standard(TCVN 8793: 2011),20-30 primary school boy children would require at least a urinal, a toilet, and a sink. For female school students, a toilet and a sink would be required for maximum 20 students.

1.2.2. Component 2

This component includes investments in construction of the roads and embankments on the northern and southern banks of Cai River, Chu Dong Tu street and Road No.4. The locations of work items under Component 2 are shown in Figure 1-8.

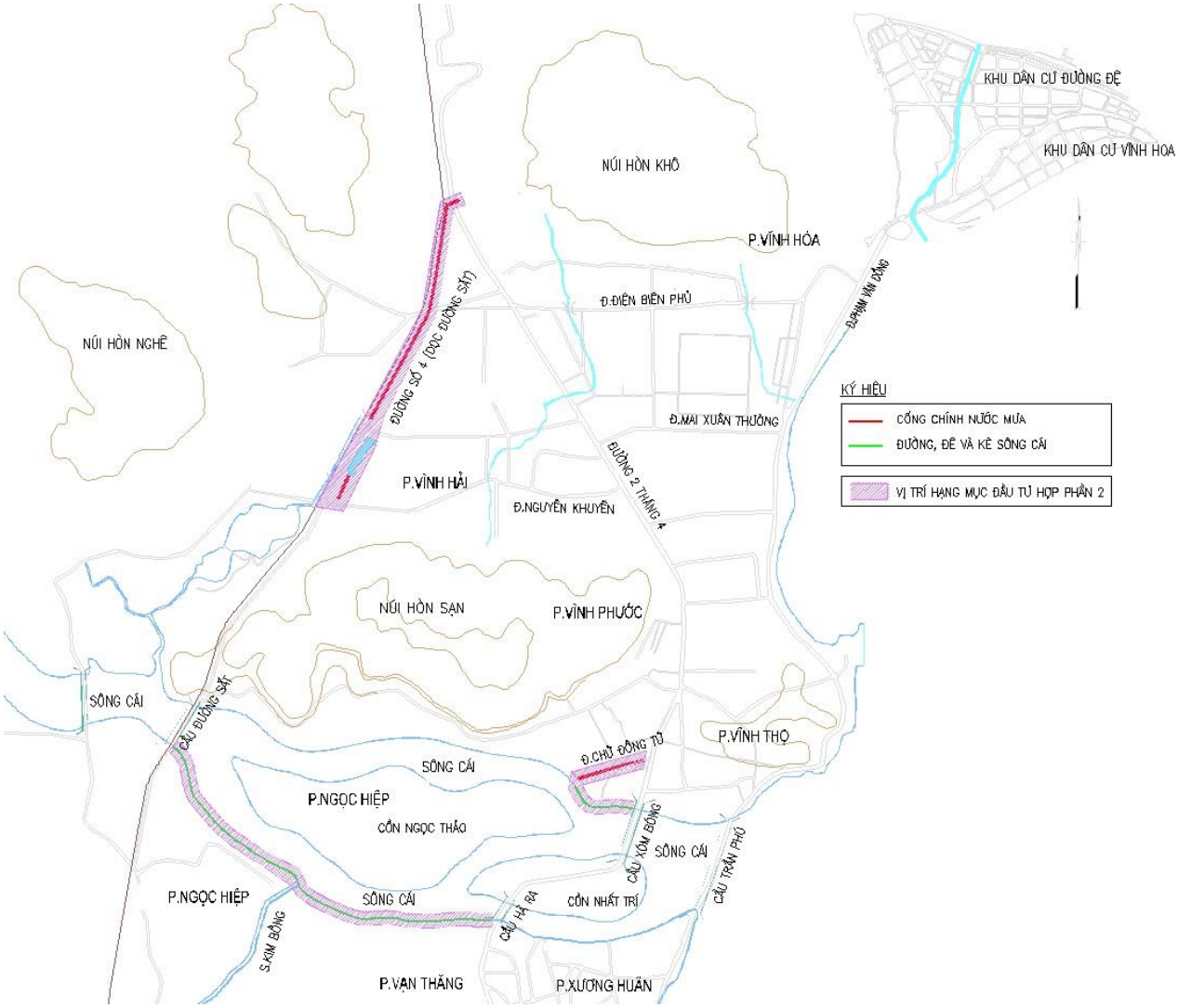


Figure 1-8. Plan of work items under Component 2

The main specifications are presented below:

- To prevent flooding and bank erosion, 423m of embankment of the northern bank of Cai River from Xom Bong bridge to Chu Dong Tu Road would be constructed with green landscaping. The embankment structure would be designed with 02 types, gravity embankment and wall corner embankment on pile.
- 2,064 m of road would be constructed on the south of Cai River from the railway to Ha Ra bridge. This would be a two-way road 16m wide, including a 2m separating strip in the middle. The pavement would be 5m on the residential area side and 7m on the river bank side. The right of way would be 28m wide. The road would be equipped with a full infrastructure including drainage, electric systems, lighting system, trees, and telecommunication systems. In every 10m, a slot would be reserved for tree planting.

- 2,026 m of embankment on the south bank of Cai river would be constructed from the railway to Ha Ra bridges to prevent flood. The types of embankments would be gravity and corner wall on pile.
- 321m of Chu Dong Tu road would be constructed. The road would start from the crossing point with the planned road along Cai river; the end at the crossing with Dinh Cong Tru road. The two-way road would be 8m wide; 3m of payment, and 14m of right of way. The technical infrastructure would include the drainage, trees, and lighting system.
- The investment in the sewer lines along Chu Dong Tu road would include circular sewers of 1,500mm in diameter (D1500) with a length of 251m. The box culvert would be 2m by 1.5m (BxH=2.0x1.5m) and 78m long.
- 1,828 m of No.4 road would be constructed. The two-lane road would begin from the crossing with the April 2 street and end at the crossing with Nguyen Khuyen road. The road would be divided into two sections: (1) The 1,100m long section from Nguyen Khuyen to Nguyen Xien road. The road width would be 12m with a sidewalk of 2.5 next to the railway and another sidewalk of 4m on the other side; (2) The 728m long section from Nguyen Xien to the April 2 street, 12m wide with a 1m sidewalk next to the railway and another 4m sidewalk on the other side. The technical infrastructure would include the drainage, trees, and light system.

1.2.3 Component 3

Component 3 includes compensation for the affected and resettled households, site clearance, and livelihoods of the local people. The subproject will not built a new resettlement site, but relocate the affected households who must be resettled to the available resettlement sites of the city. These resettlement sites are Ngoc Hiep, Hon Ro 2, and Dat Lanh resettlement sites. Due diligence of resettlement areas is presented at the Appendix 3. Details of the resettlement sites are described below.

a. Ngoc Hiep Resettlement Site

The resettlement area of Ngoc Hiep Ward, Nha Trang City, Khanh Hoa Province occupies 14.36 ha. The area for building talus and drains is 0.92ha. This resettlement area is being proposed for investment for the period from 2016 to 2018 and will include 403 land lots ranging from 70m^2 to 148m^{2}for the CCSEP.

b. Hon Ro 2 Resettlement Site

This resettlement area is located in Hon Ro 2 village, Phuoc Dong commune, Nha Trang City, and is 5km from the city center. According to Nha Trang City Construction Works PMU, the resettlement site is under construction, with about 50% of the works completed. It is expected that construction of the resettlement site will be completed and put into operation by Quarter IV/2016. The site can reserve over 200 land lots for the CCSEP.

c. Dat Lanh Resettlement Site

The resettlement area is located in Dat Lanh village, Vinh Thai commune, and occupies 5.9 ha. It is 5km from the city center. The resettlement area contains 341 land lots varying from 70 m^2 - 90 m^2. The site was completed in 2011 for resettlement of the households affected under the World Bank-financed CCESP–Nha Trang Subproject. According to the Center for Land Development Nha Trang, as of February 2016, 300 land lots are available for the CCSEP.

1.2.4 Component 4– Institutional Arrangements and Utility Reform

This component will provide technical assistance for the Employer, the management agencies through independent consulting services, seminars, experience sharing, and periodical review workshops during implementation progress, and development of managerial procedures. Support

on sectorial institutional reform to promote efficiency during the operation and ensure the sustainability of the projects as well as experience sharing with other localities on ODA project management of drainage, environmental sanitation fields will be implemented. This Component also includes subproject management of the Employer and control activities of implementation process in compliance with regulations of the Government and the community-based media program to disclose information, raise awareness on environmental protection for the people in the subproject area.

1.2.5. Auxiliary Facilities

a. Options of Power, Water Supply for Construction

The work items would be supplied with power from the 22kV and 0.4kVvoltage lines provided by Khanh Hoa Power Company. The main power required for the WWTP would be supplied from the 22kV power distribution system in the North. Water supply for construction would be taken from the Vo Canh and Xuan Phong Water Supply Plants or water to be trucked to the construction site.

b. Worker camps

It is estimated that the subproject would mobilize about 825 workers, many of whom would be hired locally in the subproject local communities. Therefore, worker camps would be required for only about 300 workers, contractors, and engineers at the construction sites at the regulation lake, the WWTP, and the northern and southern embankments of Cai River. 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, and restrooms in schools. Renting local resident's houses would be another option to reduce footprint of the worker camps.

c. Other items

Warehouses for material and equipment would be set up. Piles would be precasted before their transportation to the construction site.

d. Access road to construction site

For the tertiary sewers in the south and center of the city: The access roads to the construction site would be the existing roads where the sewers are to be installed, including Le Hong Phong street, April 2 street, provincial road No. 657, internal roads in the12 wards of Loc Tho, Phuoc Long, Phuoc Hoa, Xuong Huan, Van Thanh, Phuoc Tien, Phuoc Tan, Phuong Sai - Van Thang, Phuong Son,Vinh Nguyen, and Tan Lap.

*For the area for construction of Road No. 4 and the balacing lake:*The main access to these sites are Nguyen Khuyen street, the temporary road from Nguyen Khuyen street(Vinh Hai ward),and Nguyen Xien street.

For the WWTP area and the drainage pumping stations: The main access would be Ngo Den road, Hung Loc Hau road (Vinh Ngoc ward).

For the sewers in the northern area, wastewater collection sewers, wastewater pumping stations, and CSOs, Chu Dong Tu street: The access road to the sites would be internal roads in the north of the city.

For the roads and embankments on the southern bank of Cai River: The access to the construction site would be the waterway transport on Cai River, Ngoc Hiep village road, April 2road, and the temporary roads on site.

For the roads and embankments on the northern bank of Cai River: It can be accessible by the waterway on Cai River, the road through Thong Nhat Collectives, and the temporary roads on site.

1.2.6. Location of Disposal Sites

For the domestic wastes of worker camps: The domestic wastes generated by the worker camps would be collected and disposed of at Luong Hoa solid waste landfill. The leachate treatment plant and Huong Hoa solid waste landfill constructed under the CCESP and started their operation in February 2014. The landfill occupies an area of 12.8 hectares in Phase 1 with a designed capacity of 3.3 million tons and is expected to last for 12-21 years.

For hazardous waste: The generated hazardous wastes would include waste oil and lubricants (about 114 l per month), oily rags, oil and lubricant containers (about 50 kg per month). The contractor shall comply with Circular 36/2015/TT-BTNMT on hazardous waste management and sign a contract with an authorized agency for the collection, disposal, and treatment theses hazardous wastes.

For the excavated and dredged materials at Cai river and the WWTP area: These excavated soils could be used for leveling or planting salinity tolerant halophytes. According to the city planning, the new urban administrative center area would need about 4.77 million cubic meters of soil for backfilling. The salinity level of the soil and groundwater in this area is the same of the soil in Cai river area. The new urban administrative center would occupy 126 ha, belonged to Vinh Thai commune, Nha Trang city. The center borders Phong Chau road on the north, the route connecting commercial-service-finance-tourist-urban center on the south, the right bank of Quan Truong river on the east, and south-north route on the west.

Figure 1-9.Location of Luong Hoa landfill and the Urban Administration Center

1.3. Construction Method and Construction Technology for Subproject Work Items

Network construction solution

All kinds of reinforced concrete culverts would be prefabricated by means of vibration or centrifugal casting plant. The box culverts would be casted or assembled in-situ, depending on the actual terrain and capacity of the contractors. The construction works at the sites such as checking manholes, gas collection wells, separating wells would be constructed by direct on-site concrete casting method.

The trenches for installing the sewers would be constructed by manual or mechanical open excavation methods using Larsen steel sheet piles or steel sheet bracing system. The steps for construction of the culverts are shown in Figure 1-10.

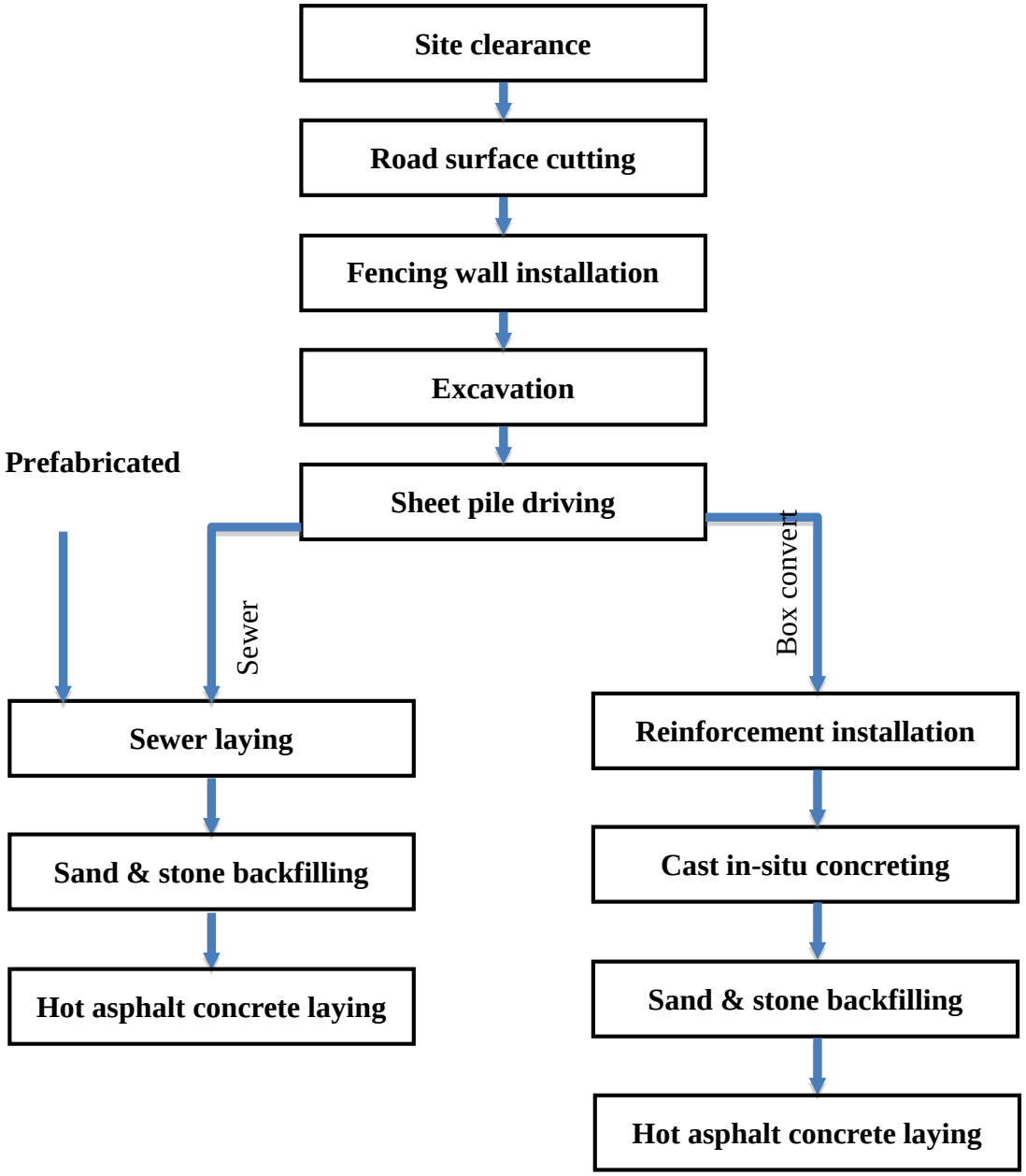


Figure1-10.Diagram of sewer construction sequence

Construction method for wastewater pumping station

The wastewater pumping station would be constructed by in-situ concrete casting. Excavation of the pumping station foundation would be executed by manual or mechanical open excavation with use of Larsen sheet piles or steel sheet bracing system.

Construction method of the WWTP

The weathered soil layer would be excavated with subsequent leveling layer by layer of 200mm thick and compaction by a factor of K = 0.95.Reinforced concrete piles would be prefabricated. Construction and production of concrete: Concrete would be poured on site, the pit more than 3m deep would be constructed by mechanical open excavation using Larsen sheet piles.

Embankment construction method

Construction of the embankments would follow the following procedures: Preparing the ground, pile casting lots, pile storage site, materials warehouse, electricity, and water. Construction would

be implemented from the river to the bank side. Construction sequence: Clearance of obstacles cleanup dredging excavation → embankment piling → erosion shelf mounting →surechiselling the pile, spray mix macadam surface leveling pouring concrete stone wall → corner macadam paving mixture, sprayed → geotextiles and embankment leveling. The dredged materials would be stockpiled less than 1.5m high and at least 20m from the river embankment, and with cover to not spill to the surrounding environment. The excavated materials would be used for construction of the dykes. The unused dredged materials would be transported to the designated dumping sites authorized by the relevant agency.

Road construction method

Construction of subgrade layer:

- Before laying materials, road foundation would be watered to the best moisture for rolling. If moisture of material is not sufficient, material shall be laid in parallel with watering, using container vehicle equipped with portable spraying nozzle heading upward as raining to avoid washing out small grained particles, simultaneously ensuring evenly spray. Shower nozzle is used or watering in narrow spaces.

Construction of asphalt concrete layer:

- Construction of compacted asphalt concrete mixtures: Compaction, rolling shall be taken wherever asphalt paver passes as to ensure mixture still in proper conditions, and when rolling and compaction do not cause material cracked or displaced.
- Rolling sequence:

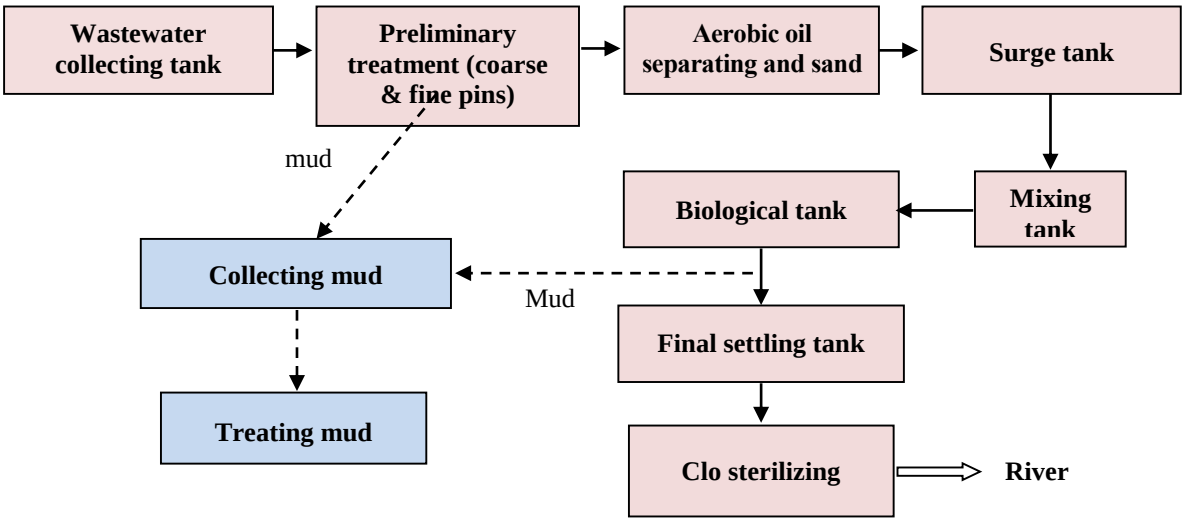
  + Step 1: Preliminary rolling. Use 6-ton iron wheel rollers to roll 2-4passes in one place with a speed of 1.5-2 km/h to stabilize materials.

  + Step 2: Use rubber wheel rollers of 14-16 tons to tightly roll with a speed of 2 - 3 km/h in the first 6-8 passes and increase to4-5 km/h for next 4 passes.

  + Step 3: Use a heavy iron wheel rollers of10-12 tons to roll 4-5 passes per one point with a rolling speed of 2-3 km/h until no rolling trace is found.

1.4. WWTP Technology and Operation

The WWTP would use the treatment technology of deep oxidation ditch, using submersible air scouring devices and surface mixer (big rotor). This solution is suitable with simple operation and maintenance conditions. The wastewater treatment process is as follows (Figure 1-11):



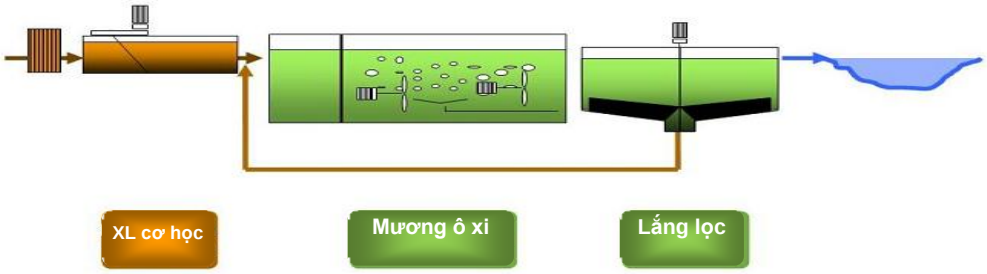


Figure 1-11.Diagram of treatment process

(1) Wastewater treatment process:

Influent tank: Wastewater is conveyed from main pumping station to influent tank of WWTP through pressure pipe. Influent tank is connected to odor control and treatment system. Wastewater then is treated through treatment processes as follows:

- Wastewater from influent tank flows through two coarse screeners with 30mm wide slots installed in screening building to remove coarse particles, such as leaves, plastics, big sized wastes, etc. Wastes retained on coarse screener are automatically raked by a cleaner and conveyed to containers by a chain belt, collected, and disposed to Luong Hoa landfill (Luong Hoa Village, Vinh Luong, NhaTrang).
- After removal of coarse wastes, wastewater flows through two fine screeners with 6mm wide slots to remove small sized particles, such as pieces of papers, plastics, etc. The screeners are automatically raked by cleaning device, and such wastes are conveyed by the chain belt to feeders of 02 waste compressors and disposed in $6m^3$ containers and transported to the landfill. The contaminated water containing organic particles from the compressors shall be discharged to the internal wastewater system and pumped back to influent chamber of screening building.
- After flowing through fine screeners, wastewater is conveyed into 2 air-scouring sedimentation tanks for sediments/sand settling. One air-scouring system consisting of a series of air distributing pipes arranged along tank walls is installed in each tank. Air is feeded from a rotary piston blower through air pipes installed along tank wall. To remove sediments, grease, each tank shall be equipped with raking devices at the bottom (for sediment removal) or at the surface of the tank (for grease removal).
- After sand settled and grease removed, wastewater is conveyed to distribution tank located in front of 2 anoxic tanks, then flows to anaerobic tanks 1 and 2 through overflow gates.
- Each anaerobic tank shall have the volume of 605 m^3 to optimize the recycled activated sludge-wastewater mixing process, as well as for phosphorus removal process.
- Wastewater, after phosphorus removal, is conveyed to oxidation ditch for biological elimination of organic carbon substances (COD and BOD5), Ammonia and Nitrate Nitrogen as well. Oxidation ditch consists of 2 compartments, each separated by sluice gate. Tanks shall be equipped with surface air-scouring devices (big rotor) as well as low speeded submersible mixers.
- Wastewater, after flowing through oxidation ditch, is conveyed to 02 final sedimentation tanks for activated sludge removal. In case one tank is closed, the remaining tank is capable of intensified operation abnormal flow conditions. Deposited sludge is raked into sludge funnel in the middle of tank bottom by inclined raking bars at bottom of rotary sludge bridge. Sludge in the funnel is collected into sludge chamber and pumped back to excess/recycled sludge pumping station, then pumped to sludge chamber (activated sludge)

or to sludge gravity thickener (excess sludge). Foam can be formed on surface water of sedimentation tank, and is eliminated by raking bars into foam pumping chamber installed on sludge raking bridge. Foam is pumped into internal wastewater system, and flows to foam collection chamber and then pumped to influent chamber of screening building. Wastewater in final sedimentation tank rises up and overflows into effluent chamber and then flows in gravity into effluent collection tank. Wastewater is disinfected by chlorine and flows through measuring chamber to receiving body (river).

(2) *Odor treatment, control:* To avoid problems of offensive odor, odor treatment and control equipment includes a combined system of chemical dosing device to be installed as the primary treatment process, and then biological treatment using bio-microorganisms filters.

(3) *Sludge treatment process*: The selected option is dewatering and mechanical thickening for mixed sludge (excess sludge and activated sludge) by a combined system (which is thickened by gravity conveyors and compressed by chain belt) until the dry level of solids reaches 20% of density. The dried sludge then will be disposed to the landfill. Sludge treatment component is designed with following facilities: (a) Septic sludge receiving tank, (b) Preliminary sludge thickening by gravity, (c) Sludge storage tank 1, (d) Mechanical thickener, and (e) Foam collecting tank.

1.5. List of Machines and Equipment

The machines and equipment would be required for the construction activities are presented in Table 1-8 below:

Table 1-8. Construction equipment and fuel

Equipment	Capacity/equipment diesel/shift	Number of shifts	Amount of fuel required (liter)
Dump truck 10T	56.7	219.2	12,429
Water tanker, 5m^3	22.5	32.1	722
Excavator 0.8m^3	64.8	88.1	5,709
Wheel compactor 16T	37.8	278.0	10,508
Wheel compactor 25T	67.2	1.8	121
Rolling compactor 8.5T	24	1.2	29
Rolling compactor 10T	26	70.7	1,838
Vibration compactor 25T	54.6	32.1	1,753
Plate compactor	3.57	980.3	3,500
Prefabricated vertical drain driving machine	47.85	2.6	124
Diesel air compressor 600m^3/h	54	20.2	1,091
Bulldozer 110CV	46.2	176.2	8,140
Spreader 50-60m^3/h	30.2	10.3	311
Spreader 130-140CV	63	19.6	1,235
Grader 110CV	40	11.9	476
Asphalt sprinkler	57	21.9	1,248
Digger1,6m^3	75.2	24.8	1,865
Total fuel (liter diesel)			51,099

1.6. Subproject area of influence

The subproject will invest for the construction of works, including wastewater and stormwater drainage system; three (03) traffic routes and Northern WWTP of the Nha Trang city; dyke along Cai river bank; tertiary culvert system in both the Northern and Southern of Nha Trang city. Thus, the area to be affected by the construction and operation of the subproject includes 18 wards/communes in Nha Trang city area. However, the mainly affected areas are Northern and

center area of the city, including 7 wards/communes Vinh Hoa, Vinh Hail Vinh Phuoc, Vinh Ngoc, Ngoc Hiep, Van Thang and the downstream area of Cai river, the river segment, which flows through Ngoc Hiep and Van Thang ward (approximately 2km). There are many big buildings. The subproject will only construct tertiary culvert system at the Southern area of the city so negative impacts to the area are negligible. In addition, the subproject also would not cause negative impacts to the suburban area of the city, where concentrated natural ecological zones. Those natural ecological zones is away 15-80km of distance from project area.

1.7. Material Supply

The subproject would purchase materials from the sources and companies available in the province and city. There are some sources of raw materials in the city. The local mines surveyed in the province (3 mines including 01 to the South of Hon Ngang of in Dien Lam commune and 02 to the West of Hon Ngang in Dien Lam commune, Dien Khanh district, Khanh Hoa) are located 30km from the Subproject site on average. The ESIA Consultant has conducted a survey of these materials sources to assess their compliance with environmental and health safety requirements. The details are represented in Appendix1**.**

Table 1-9.List of some material mines in Khanh Hoa province (within a radius of 30 km from the city center)

Source: Khanh Hoa Department of Natural Resources and Environment

	Granted Company	**Permit No.**	**Location of explory, exploitation**	**Area (ha)**	**Approved reserve (m^3)**	**Exploited reserve (m^3)**	**Exploited capacity (m^3/year)**	**Permitted period**	**Current status**
1	Khanh Hoa Traffic Supplies and Equipment JSC	5681/QĐ-UB 05/2/1997	South Hon Ngang quarry, Dien Lam commune	20	Soil:938,560 Stone: 17,856,000	Soil:0 Stone:6,522,690	Soil:0 Stone:110,000	30	Being exploited
2	An Phong Road and Bridge Technology JSC	1926/GP-UBND 9/8/2013	Hon Ngang West quarry, Dien Lam commune	5,000	Soil:160,918 Stone: 2,171,357	Soil:117,405 Stone:1,692,960	Soil:12,284 Stone:100,000	17.5	Being exploited
3	Khanh Hoa Traffic construction and Management JSC	3511/GP-UBND 31/12/2013	West Hon Ngang quarry, Dien Lam commune	3,600	1,170,908	954,541	43,480	22	Being exploited

Quantity of fuel, material:

Table 1-10. Power Demand

No.	Content	Unit	Quantity
	WWTP	kWh	913
	Drainage pumping stations	kWh	1,900
	PS5	kWh	191
	PS 1, 2,3 4	kWh	10

Table 1-11.Quantityof excavation and filling materials

No.	Work items	Excavation(m^3)			Ground filling (m^3)	Crushed stone 1x2 (m^3)	Coarse sand(m^3)	Fine sand (m^3)	Concrete, aggregate 1x2	Concrete. aggregate 4x6
		Ground (m^3)	Topsoil (m^3)	Foundation (m^3)						
1	Collection sewers	102,679			47,484	6,284	2,389	8,655		
2	Drainage pumping station	6,348	3,072	5,417	16,963				30	25
3	Waste-water pumping station									
	PS 1	461				7			42	
	PS 2	439				7			40	
	PS 3	497				6			45	
	PS 4	471				6			43	
	PS5	2,360	915		8,036	44			486	21
4	WWTP	7,932	17,302		68,875					
5	Balancing lake	11,500	1,390		9,695					
	Total	**132,687**	**22,679**	**5,417**	**151,053**	**6,354**	**2,389**	**8,655**	**686**	**46**

Source: Investment project report

No.1 pumping station: Steel: 6344kg, Cement: 18730 kg

No.2 pumping station: Steel: 5960kg, Cement: 17614kg

No.3 pumping station: Steel: 5960kg, Cement: 17614kg Khối lượng sắt thép6792 kg**,** khối lượng xi măng bền sunfat 19880 kg

No.4 pumping station: Steel: 6494kg, Cement: 19019kg

No.5 pumping station: Steel: 53856kg, Cement: 266659kg

Stormwater pumping station: Steel: 264780kg, Cement: 1980764kg

Blancing lake: Cenment 358110 kg

Pipelines and CSO: Steel: 2550 tons, Cement: 7937 tons

Wastewater treatment station: Steel: 1225 tons, Cement: 2998 tons

Quantity of dredged soil in the South of Cai river: 88,400m^3

Quantity of dredged soil in the North of Cai river: 5,430m^3

The quantity of materials for the roads and embankment in Northern Cai River area is estimated as 4,100$m^3$of sand, 2,100$m^3$of stone and 12,000$m^3$of concrete, 2234 tons of steel, 6640 tons of cement

The quantity of materials for the road and embankment in southern Cai River area is estimated as 2,500m^3 of sand, 300m^3 of stone and 800m^3 of concrete, 270 tons of steel, 903 tons of cement**.**

No. 4 road: 68299 kg of steel, 727077 kg of cement

Chu Dong Tu road: 727 kg of steel, 107173 kg of cement

Table 1-12.Quantityof excavation, filling/ Material demand for road construction

Work content		Road No. 4	Chu Dong Tu Road	Total
Excavation(m^3)	Ground	8,233	256	8,489
	Topsoil	8,798	727	9,525
	Formation	4.52	1.643	6,163
foundation filling (m^3)		39,807	2,605	42,412
Fine asphalt concrete (m^3)		859	111	970
tack coat 0.5 kg/m^2 (m^2)		1,718	2.218	3,936
Medium asphalt concrete (m^3)		1,266	168	1,434
tack coat 1 kg/m2 (m2)		18,083	2,398	20,481
Macadam type 1 (m^3)		2,712	360	3,072
Macadam type 2 (m^3)		5,425	719	6,144
Compacted soil K98 (m^3)		9,041	1,199	1,024
Block tile area (m^2)		4,271	867.11	5,137

The subproject construction process would generate 184,690 m^3 of excavated soil, including 32,204 m^3 of dredged topsoil, disposed of at Luong Hoa landfill. Due diligence of Luong Hoa landfill is presented at the Appendix 2.

1.8. Subproject Implementation Schedule

Subproject implementation period: 2017 – 2022

Implementation period of packages is as follows (Table 1-13):

Table 1-13. Implementation schedule

No.	Package code	Package name	Expected date of signing the contract	Expected date of completion of the contract
I	Phase I			
1	NT-1.01	Construction of tertiary sewers and replacement of odor prevention manholes	Quarter III/2017	Quarter IV/2018
2	NT-1.02	Construction of drainage sewers	Quarter III/2017	Quarter IV/2018
3	NT-1.03	Construction of pump stations, CSOs and primary, secondary, tertiary wastewater network	Quarter III/2017	Quarter IV/2018
4	NT-1.04	Construction of school sanitation blocks	Quarter III/2017	Quarter IV/2018
II	Phase II			
1	NT-1.05	Construction of pump stations, CSOs and primary, secondary, tertiary wastewater network	Quarter IV/2018	Quarter II/2021
2	NT-1.06	Construction of drainage pumping station	Quarter I/2019	Quarter II/2022
3	NT-1.07	Construction of Northern wastewater treatment plant	Quarter II/2019	Quarter I/2022
4	NT-2.02	Construction of road and technical infrastructure (including drainage sewers)	Quarter I/2019	Quarter IV/2021
5	NT-2.01	Construction of roads and embankments along the Cai river	Quarter I/2019	Quarter II/2022

1.9. Investment Capital

Total investment: **72 million USD,** including

- ODA: USD 60.6million
- Grant aid USD 0.3 million
- Counterpart fund: USD 11.1 million.

1.10. Subproject Management and Implementation

Organization:

- Implementing Agency: Khanh Hoa Province People's Committee;
- Employer: Khanh Hoa Development Project Management Unit
- Donor: World Bank (WB)

Management structure:

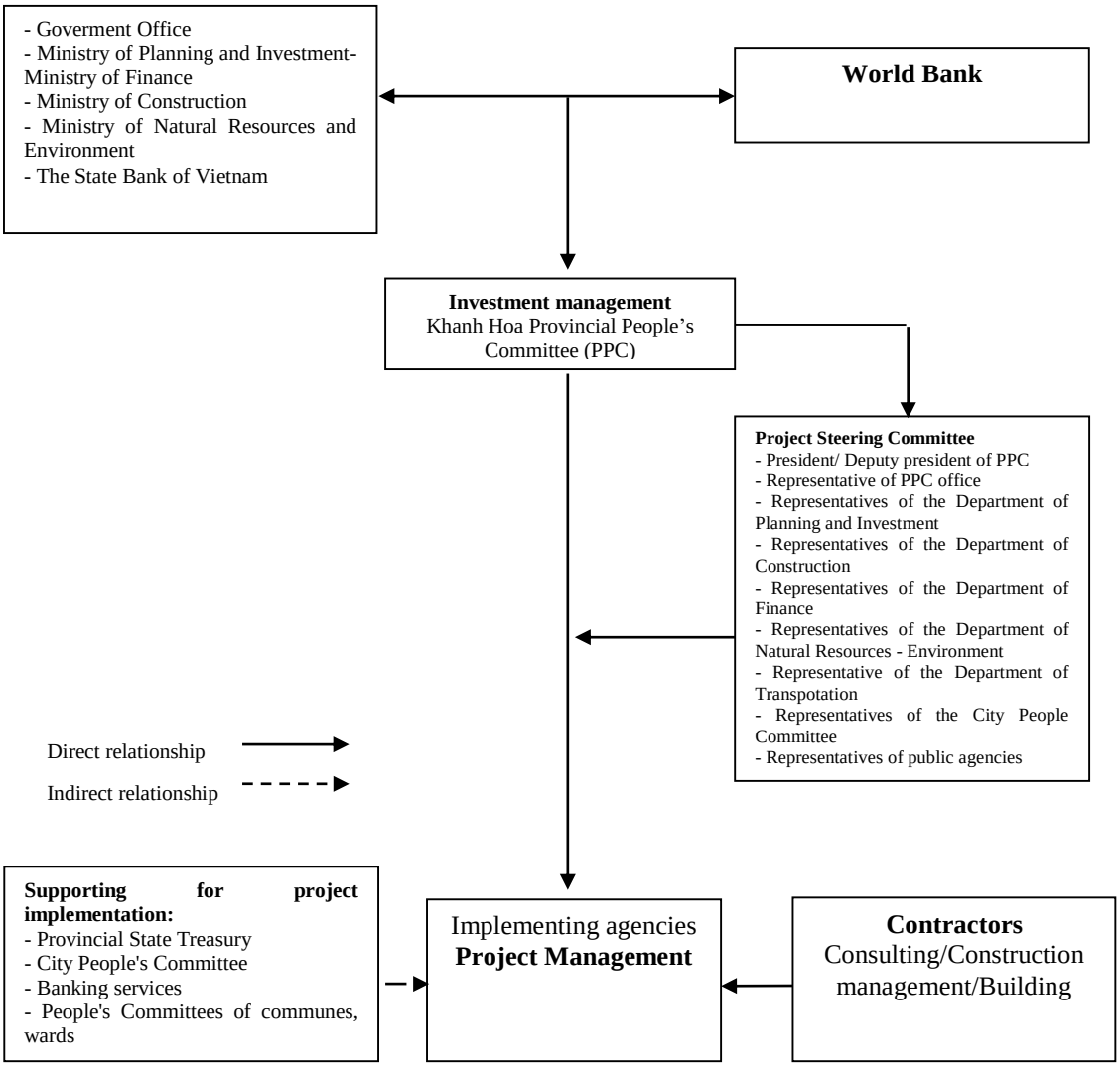


Figure 1-12. Management diagram

CHAPTER 2. NATURAL ENVIRONMENTAND SOCIO-ECONOMIC CONDITIONS

2.1 Natural Environment Conditions

2.1.1 Geographical and Geological Conditions

Geographical conditions:

Nha Trang City is located on the Eastern coast at 12°15N and 109°12E, 450km North of Ho Chi Minh City and 1,280km South of Hanoi, the country's capital. Nha Trang City is in the easternmost coastal part of Vietnam with a coastline of over 30km, conveniently linking it with other regions of the whole country and the world. Nha Trang City adjoins Ninh Hoa district to the North, Cam Lam District to the South, the East Sea to the East, and Dien Khanh district to the West.

Below is the list of the wards and communes where the subproject would be implemented:

Table 2-1. List of wards and communes where the Project is implemented

Northern area	Central area	Southern area	
Vinh Hoa	Ngoc Hiep	Loc Tho	Phuoc Tan
Vinh Hai	Van Thang	Phuoc Long	Phuong Sai
Vinh Phuoc		PhuocHoa	Phuong Son
Vinh Tho		Xuong Huan	Vinh Nguyen
Vinh Ngoc		Van Thanh	Tan Lap
		Phuoc Tien	

Topographical features

Nha Trang city features 03 topographical area: The coastal delta area and the riverside area of Cai river of 81.3 km², accounting for 32.33% of the whole city's area; the transition area and low hills with a slope from 3° to 15° located mainly in the West and Southeast and on the city's small islands, accounting for 36.24% of the area; and the mountainous area with a declivity of over 15°to the Northern and Southern ends of the city, on Hon Tre island and a number of other stone islands, accounting for 31.43% of the whole city's area.

- The Northern area of Cai river (The site of construction items under Component 1 and the Northern embankment of Cai River under Component 2):

This area, including the main residential areas in Vinh Hai and Vinh Tho wards, has a relatively flat terrain of an elevation between 3m and 3.5m.. This area is greatly affected by floods from Hon Kho Mountain, resulting in frequent flooding during the rainy weather. The residential areas in Vinh Tho and Vinh Phuoc wards are located along the foot of Hon San and Hon Chong mountains, in a highly sloped terrain with an elevation between 5.1m and 24m. Son Thuy residential area is located along Cai river with an elevation between 0.5m and 5.1m.

- The Central area (The construction site of the secondary drainage sewers under Component 1, the roads and the embankment to the south of Cai River under Component 2):

The inner-city roads are ona flat terrain with an elevation between 3.9m and 4.2 m. The urban areas to the West of Le Hong Phong Street and along Tac River run through the fields in the West with a lowland terrain and an elevation between 0.5m and 1.5m.

- The Southern area (The site of construction of tertiary sewer lines under Component 1:

This area has a flat terrain with an average elevation between 2.4 and 3.5m.

Geological conditions:

The Northern WWTP area: According to geological survey results, the geological strata of the construction site from the ground to a depth of 15.0m comprise the following layers:

- Layer 1: Backfilling soil: brown grey and dark grey mixed clay. This layer would be removed during construction;
- Layer 2: grey mixed clay sand liquid to plastic intermingled with grit and sand nests at some places. The layer is weak and unfavorable for construction requiring handling solutions;
- Layer 3: mixed clay mud, dark grey, intermingled with organic matter and sand nest sat some places. The layer is weak and unfavorable for construction, requiring handling solutions;
- Layer 4: porous gravel sand mingled with sea shells and mixed clay mud. The layer is weak and unfavorable for construction, requiring handling solutions;
- Layer 5: brown grey, blue grey, and white grey mixed clay sand, plastic, mingled with grit. The soil layer has a medium-to-fair load-bearing capacity;
- Layer 6: Gravel grit, compact, mingled with brown grey, yellow grey, curdling clay. The soil layer has a high load-bearing capacity;
- Layer 7: white grey and yellow grey clay sand, plastic, mingled with grit. The soil layer has a medium-to-fair load-bearing capacity;
- Layer 8: white grey granite firm, mingled with grit, and moderately to strongly weathered with cracks. The soil layer has a high load-bearing capacity.

The survey results show that Layer 1 (backfilling soil)is to be removed during construction; Layers 2, 3 and 4 are weak soil layers and thus unfavorable for construction and would require proper handling. Layers 5 and 7are soil layers with a load-bearing capacity from medium to fair. Layers 6 and 8 are those with a high load-bearing capacity. For such construction items of great loads and deep foundations as sedimentation tanks or reaction tanks, Layer 6 or Layer 8 would be used as load-bearing layers.

Cai river embankment area: According to the Feasibility Study report, the geological strata of Cai River area are divided into many layers, of which those closer to the surface vary a lot in thickness and surface elevation. Relatively thin tectonic lenses take shape in many layers. The bedrock surface varies significantly in elevation, clearly featuring the characteristics of geological distribution of foothill areas. Geological properties are clearly of both riverbed and coastal sedimentation. The top-down geologic strata distribution is as follows:

- Layer 1: white grey and yellow coarse sand and gravel sand, from porous to moderately to medium dense;
- Layer 2: Dust sand and fine sand mingled with sea shells, medium dense. This layer is locally distributed;
- Layer 3: Clay mud mixed with dust sand, dark grey, pasty. This is a weak and unstable soil layer in terms of long-term ground settlement;
- Layer 4: Mixed clay mingled with clay mud, dark grey pasty. According evaluation criteria, this is a weak soil layer;
- Layer 5: Mixed clay mingled with clay mud pasty. According evaluation criteria, this is a weak soil layer;

- Layer 6: dark grey gravel soil mingled with sea shells, medium dense;
- Layer 7: Sandy clay and silty clay mingled with grit, yellow grey, solid;
- Layer 8: Granite, composed of feldspar, quartz, mica; pink in color; high shear strength.

The above geological characteristics reveal that the geological strata of the riverbed are mainly fine and medium-sized sand layers in a loose state, easily eroded by water flow, especially floods. The middle layers down to Layer 5 are those with mixed sand mingled with clay mud, and are thus pulpy, poor in load-bearing capacity, and likely to settle and creep due to upper loads. Great variations in the surface and thickness of these layers must be properly addressed in the design of the work foundation. Therefore, structurally, in designing the embankment, proper attention must be paid to the structure of cut-off walls in order to prevent both erosion and local settlement along the route.

*Construction site of Road No. 4 and balancing lake (in Vinh Hai ward):*From top down, the geological layers of this site are as follows:

- Layer1: Backfill soil: mixed clay mingled with construction waste of heterogeneous components;
- Layer 2A: dark grey mixed clay mud, mingled with organic matters;
- Layer 2: yellow grey or blue grey mixed clay, soft-plastic, mingled with grit;
- Layer 3: blue grey, yellow grey or white grey clay loam, quasi-plastic, mingled with grit;
- Layer 4: (Weathered) grey, blue grey, yellow grey or white grey mixed clay, solid, mingled with macadam fragments and grit;
- Layer 5: (Weathered) blue grey, white grey or grey mixed clay, solid mingled with macadam fragments and grit;
- Layer 6: (Weathered) purple brown or grey mixed clay, very solid, mingled with macadam and grit.

These geological characteristics show that Layers 1, 2, and 2A are weak soil layers and should be removed during the construction of road foundation; the remaining layers are firm soil layers and can be used for the foundation of works with small and medium loads.

Hydrogeological conditions: The groundwater levels measured in the area are from 0.2-1.5m. Specifically, the groundwater levels in the WWTP area to the North are measured at 0.2 - 0.9m, and those along Cai river are recordedat1.5m (Geological Survey Report of the subproject).

2.1.2. Climatic and Meteorological Conditions

Nha Trang has a tropical savanna climate affected by the oceanic climate. The climate of Nha Trang is relatively temperate with the following features:

a) Air temperatures: The air temperatures in Nha Trang remain stable over the past years without significant variations. The annual average temperature recorded during the period 2009-2014 was 27.2^0C.The highest average temperature is about 30^oC in May and June while the lowest temperature is about 24^0C in December, January, and February. The lowest temperature is 26.7^0C in 2011 while the highest temperature is 27.5^0C in 2012

b) Rainfall: The annual average precipitation in Nha Trang during 2009-2014 was 1,560mm. However, the total annual rain fall in same period presents great variations. In 2014, the total annual rainfall was 972mm, the lowest over the years while the highest rainfall was in 2010, up to 2,662 mm. Since 2010, the total annual rainfall has tended to decrease, with very low and even no

rainfall in a number months in 2014. The local rainy season starts in September and lasts until December. In 10% to 20% of the years the rainy season started in July and August and ended early in November. The rainfall in the rainy season accounts for nearly 80%of the total rainfall of a year. It is forecasted that, due to the recent climate change, the rainfall will increase by 5% compared to the figures previously calculated.

c) Sunshine: The number of sunny hours in the city varies from 2,492 to 2,706 hours in the period of 2009-2014.The lowest number of sunny hours was 45 hours in December, 2011, while the highest number of sunny hours was 307 in May, 2014. The lowest annual average number of sunny hours was 198 hours in 2011, while the highest annual average number of sunny hours was 255.6 hours in 2014.

d) Storms: Storms often occur in the sea region of Khanh Hoa from September to December, most likely in October and November. On a yearly average, about 0.4 - 0.8 storms land on the coastal area of Khanh Hoa in comparison with the average of 3.74 storms/year hitting the coastal areas of the whole country. The strongest wind velocity is Level 6 and Level 7 (39-61 km/h), accounting for 55%; Level 8 and level 9 (62-88 km/h) accounting for 33%; and Level 10 (89-102 km/h) accounting for 12%. The storm season would most often coincide with the yearly rainy season, resulting in frequent accompanying heavy rains, hurting sea economic operations. However, there have been years with no storms, while other years suffered from 2 - 3 storms.

e) Waves: Big waves prevail in the Northeastern and Eastern directions with a frequency of occurrence of 60-85%. Eastern swells are those waves that strongly impact on the coast of Nha Trang bay. The subproject area is not affected by waves.

The tides of Nha Trang's sea area are of an irregular diurnal regime. Monitoring data at Cau Do gauging station in Khanh Hoa province show records of 18-20 days with diurnal tide in one month, where the duration of high tides is greater than that of ebb tides. The water level during heavy sea has a relatively clear cycle with the largest amplitude of 2.4 m and the average amplitude of high tides is 1.2 to 2m. Tidal water levels range from -1.37m to + 1.03m (VN2000 National Coordinate System). Salinity varies on a seasonal basis between 1 and 3.6%.

f) Wind regime: The area is affected by tropical monsoon climate. From September to March, prevailing wind direction is North, Northwest and Northeast wind, in which the frequency of Nothern wind is about 24.5-35.8% at an average wind velocity of about 3.25m/s. From Aprial to August, prevailing wind direction is Southeast (frequency: 17.1-24.4%),and an average wind velocity of about 4.4m/s. The Northeastern monsoon prevails from November until March, while Southwestern winds are prevalent from June to September. These winds often bring along dryness and great heat and last 5 - 7 days.

g) Humidity: The annual average humidity in Nha Trang City is fairly high and stable, varying from 77% (in 2014) to 80% (in 2009).The annual average humidity is about 78.6%

2.1.3. Hydrological Conditions

The city has two main river systems: Cai river and Quan Truong river.

Cai river:

Cai river in Nha Trang (also called Phu Loc river, Cu river) is 75 km long, starting from Chu Tu peak 1,475m above the sea level, flowing through Khanh Vinh district, Dien Khanh district and Nha Trang City, and then entering the sea at Cua Lon estuary (Dai Cu Huan). The downstream section in Nha Trang is about 10 km long. The river is the main water source for industrial and agricultural production, tourism-service operations and residents' daily-life activities in the city and adjacent districts. The construction sites of roads and embankments in the North and the South of Cai river are located downstream water intakes.

This river would receive treated wastewater after it leaves the Northern WWTP. The canal receiving treated wastewater is located in the Northern bank of Cai river, about 3km from the estuary where Cai river flows into the sea. The river section flowing through Nha Trang city has long been significantly adversely affected by human activities. The riverbed is abruptly downsized owing to the complex terrain, narrowing the water passages of many sections, forming 9 islets in the middle of the river and bank shoals which divide the flow successively into small creeks, limiting the flood drainage capacity of the estuary. This is considered as the main cause leading to flooding in upstream area sand Southwestern areas of Nha Trang. Besides, both the banks of Cai river near the estuary are thickly inhabited by residents, most of whom are poor with unstable living conditions, resulting in indiscriminate and thoughtless discharge of garbage and wastewater into the river before it reaches the sea, causing environmental pollution. In addition, encroachment of the riverbed by filling it with earth for residential purposes on the Southern bank of Cai river has aggravated the problem.

The average annual flow rate through many years of Cai river in Dong Trang with a catchment area of 1,244 km^2 reaches a total of 1.78 billion m^3/year at56.5m^3/s, corresponding to the flow module of 45.5 l/s/km^2. However, the annual flow rate does not vary substantially through the years, with a variation coefficient of annual flow of 0.37. The annual flow at a frequency of 75% is 41.3 m^3/s, corresponding to 1.3 billion m^3 of water. The lowest water flow in Cai river during the driest time of the year is 5.1 m^3/s.

Flow rates during flood seasons: The annual flood season in Cai river starts from September and lasts until December, with a difference of one or several weeks.

The flood peak flow rate at Ha Ra – Xom Bong peak is as follows (table 2-2):

Table 2-2. Peak flood flow rate of Cai river

P%	1	3	5	10
Q_{max}(m^3/s)	4,551	3,692	3,202	2,446

Water level measured in Nha Trang City: Hmax = 2.05m, Htb = 0.48m.

Quan Truong river:

Quan Truong river is a system of small rivers with a length of about 15 km, flowing through the communes of Vinh Trung, Vinh Hiep, Vinh Thai, and Phuoc Dong, and the 3 wards of Phuoc Long, Phuoc Hai, and Vinh Truong before entering Cua Be estuary. The river divides into 2 branches: the Eastern (main) branch with a length of 9 km and the Western branch (also called Tac river) with a length of 6 km.

Quan Truong river and Tac river function as the receptor of the treated wastewater from the Southern WWTP which was constructed under the CCESP. The lowest flow rate of the river is 39.1m^3/s. The highest water level is 1.03m, and the lowest -1.37m.

The hydrographical regime of Quan Truong river affects directly the area to the South of Nha Trang airport. Being only a branch of Cai river, it holds very little water in the dry season. Yet, in the rainy season, water from Cai river would overflow and discharges itself into Cua Be and Dong Bo river, causing flood son both river banks.

As planned, Quan Truong river will be trained and straightened to flow close to the extended area to the West of the city in order to ensure draining part of Cai river flow towards Cua Be.

Flooding: Every year, there would be 2 to 5 floods in Quan Truong and Cai river area. As mentioned above, part of the flood flow is discharged into Tac river to reach Cua Be. The flash flood water on the river would cause very serious flooding to the lowlands most of the time.

Flooding may last 2-3 days and set a record of a whole week in the historical flood of 1964. Most dangerously, sea waves may combine with high tides. The areas prone to frequent flooding cover most of Dien Khanh district and the lowlands of Nha Trang City such as the communes of Vinh Thai, Vinh Ngoc, Vinh Hiep, Vinh Thanh, Vinh Phuoc, and Vinh Hai and Ngoc Hiep ward, in which the communes of Vinh Ngoc, Vinh Hiep, and Vinh Phuoc and Ngoc Hiep Ward are within the scope of the subproject site. The area around the Southern WWTP is not affected by flooding.

Catchment map of Cai and Quan Truong river is shown in Figure 2-1 below.

Figure 2-1. Catchment map of Cai and Quan Truong rivers

2.1.4. Soil, Water, and Air Environment

2.1.4.1. Noise and Air Quality

The quality of the air environment at Vinh Hoa residential area was monitored by Khanh Hoa Department of Natural Resources and Environment (DONRE) in late 2014. The subproject ESIA Consultant also sampled the air at 9 positions in Nha Trang city from 27th-28thFebruary 2016. The sampling map is shown in Appendix 4. The analysis results are shown in Table 2-3 and compared with the indicators stated in the following standards:

- 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 analysis results of the air quality in the subproject area are as follows (Table 2-3):

Table 2-3. Analysis results of air quality

Indicators	Value										QCVN `05:2013/ BTNMT
	KK1	KK2	KK3	KK4	KK5	KK6	KK7	KK8	KK9	KK10	
Temperature (^oC)	29.7	25.5	24.5	24.8	25.8	28.2	25.7	28.3	28.1	32.0	-
Pressure (hPa)	1,012	1,017	1,016	1,017	1,020	1,019	1,021	1,018	1,021		-
Humidity (%)	68.7	74.6	74.0	70.8	71.0	62.8	71.3	72.8	73.0		-
Wind velocity (m/s)	1.7	2.2	2.1	3.1	1.8	0.5	1.1	1.4	1.7		-
Noise($L_{Aeq,}$ dBA)	62.7	68.5	65.6	67.9	**76.3**	53.4	51.5	**72.3**	61.0	68	70
Dust (TSP) ($\mu g/m^3$)	253	73	97	123	90	130	53	210	180	70	300
SO_2 ($\mu g/m^3$)	13	12	10	11	19	17	14	22	21	13	350
NO_2 ($\mu g/m^3$)	8	7	2	4	15	13	10	20	19	12	200
H_2S ($\mu g/m^3$)	0.05	0.4	0.04	0.04	0.5	0.08	2.6	0.4	0.5	-	42
CO ($\mu g/m^3$)	739	1,415	1,258	1,045	2,236	831	759	2,114	1,257	1,900	30,000
HC ($\mu g/m^3$)	1,000	3,600	3,333	1,733	3,867	1,267	1,200	3,068	1,600	1,600	5,000

Notes:

KK1: Area of constructing the wastewater treatment plant in the North of the city (N:12^{0}16'33,8", E:109^{0}10'11.5")

KK2: Area of Nguyen Khuyen road (near railway) - Area of constructing balancing lake and Road No. 4 (N:12^{0}16'45.1", E:109^{0}10'51.9")

KK3: Area of Duong Hien Quyen - Pham Van Dong crossroads (N:12^{0}16'55.6", E:109^{0}12'9.8")

KK4: Area of Pham Van Dong street, near Vinh Hoa Primary School (N:12^{0}17'36,9", E:109^{0}12'39.5")

KK5: April 2nd Street, near Xom Bong bridge (N:12^{0}15'59.04", E:109^{0}11'47.01")

KK6: Area near Ngoc Hiep residential quarter (N:12^{0}15'48.2", E:109^{0}10'35.5")

KK7: Area of constructing balancing lake (N:12^{0}16'57.2", E:109^{0}11'13")

KK8: PS2 pump station- Foot of Xom Bong Bridge (N:12^{0}15'52.1", E:109^{0}11'46.9")

KK9 PS3 pump station - Area of Thong Nhat Co-Operative (N:12^{0}16'0.6", E:109^{0}11'37.2")

KK10 Air sample taken and monitored at Vinh Hoa residential area by DONRE in 2014

The analysis shows that the air quality at the subproject area is fairly good, with all analysis indicators meeting the national standard on quality of ambient air and the standard on hazardous substances in ambient air. The noise at the area of Xom Bong bridge (KK5, KK8) exceeds the standard on noise as this area is located along April 2 Street, where the traffic is very heavy. The quality of air environment at site in Vinh Hoa residential area analyzed by DONRE in 2014 was assessed as relatively good, with the majority of targets of dust and hazardous gases being smaller than the permissible standards.

2.1.4.2 Surface Water

The quality of surface water environment of Cai River was monitored by Khanh Hoa DONRE at the end of 2014. The ESIA consultant also carried out sampling of the surface water at 7 locations in Nha Trang city from 27-28th February 2016. The sampling map is shown in Appendix 4. The analysis results are shown in Table 2-4and compared with the standard QCVN 08-MT: 2015/BTNMT Column A2 - National technical regulation on the quality of surface water for domestic water.

Table 2-4. Analysis results of surface water quality at the Project area

	Unit	Results	

Analysis parameters		**NM1**	**NM2**	**NM3**	**NM4**	**NM5**	**NM6**	**NM7**	**NM8**	**NM9**	**QCVN 08-MT:2015/ BTNMT Col. A2**
pH	-	7.5	7.6	7.6	7.8	7.7	8.2	7.8	6.72	6.79	**6 – 8.5**
Temp	^{0}C	25.2	25.1	26.5	26.0	25.4	25.0	25.2	29.5	29.4	–
Salinity	‰	2.7	1.6	3.2	4.0	6.8	32.6	5.6			–
TSS	mg/l	7	8	8	7	8	10	11	19.5	20	**30**
BOD_5	mg/l	**6.45**	**6.60**	**7.10**	**6.75**	**6.32**	**6.24**	**6.82**	**12**	**9**	**6**
NH_4^+ - N	mg/l	**0.61**	**0.36**	0.22	0.26	0.28	0.27	0.30	0.09	0.01	**0.3**
Cl^-	mg/l	**1311**	**993**	**1949**	**2481**	**3722**	**19497**	**3119**	**1500**	9	**350**
T-N	mg/l	8.2	7.6	7.21	6.43	7.15	8.56	7.23			–
T-P	mg/lP	3.56	0.76	0.43	1.04	0.4	0.45	2.94			–
Total Fe	mg/l	0.83	0.82	0.87	**1.09**	0.95	0.96	**1.97**	0.6	0.8	**1**
As	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	**0.02**
Mn	mg/l	**1.32**	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05			**0.2**
Grease and oil	mg/l	0	0	0	200	0	0	15			**0.5**
Coliform	MNP/ 100ml	340	674	743	840	823	663	250	**10^5**	**$3*10^4$**	**5000**

Notes:
NM1: surface water at the water creek near WWTP (discharge receiving point)
NM2: surface water at the position of water creek joining Cai River
NM3: surface water of Cai river at the area of Southern embankment - upstream Cai River
NM4: surface water of Cai river near Ha Ra bridge - downstream Cai River
NM5: surface water of Cai river at the area of Northern embankment (near Xom Bong bridge) - downstream Cai River
NM6: coastal sea water at the position of CS04 discharge gate (Tran Phu street)
NM7: surface water of Cai River at CS03 discharge gate (near existing canal adjacent to Son Thuy Shipbuilding Enterprise)
NM8: surface water of Cai River at Cau Sat Bridge
NM9: surface water of Cai River near Vo Canh Water Plant

The analysis results of the surface water quality show that Cl^- levels in the water samples exceeded the standard by 2.8 to 10.6 (except the water samples taken near Vo Canh water supply plant). This indicates that the surface water at the area had been exposed to salinity intrusion (with the salinity of the surface water samples varying from 1.6-6.8‰).The rate of salinity intrusion into Cai River is approximately 3-4km. In the dry season, salinity intrusion into Cai River may reach as far as nearly 10km.The contents of grease and oil in the water samples of Cai River taken near Ha Ra Bridge (NM4) exceeded the standard by 400 times. The iron contents in samples taken at NM4 and NM7 also exceeded the standard. The BOD5contentsexceeded the standard by 1.05 times to twice. Ammonium contents also reveal signs of pollution. The reason for this surface water pollution was that the place where rivers receive great amounts of untreated wastewater and waste from households, production establishments and services.

2.1.4.3. Domestic Wastewater:

The ESIA consultant of the subproject also sampled domestic wastewater at 7 locations in Nha Trang city from 27-28thFebruary 2016. The sampling map is shown in Appendix 4. Analysis results are presented in Table 2-5 and compared with the standards stated in QCVN 14:2008/BTNMT column A - National technical regulation on wastewater quality of domestic wastewater as follows:

Table 2-5. Quality of wastewater in Nha Trang city

No.		**Unit**	**Result**	

	Analysis parameters		**NT1**	**NT2**	**NT3**	**NT4**	**NT5**	**QCVN 14:2008/ BTNMT Col. A**
1	pH	-	6.6	7.2	7.3	8.2	7.0	**5 - 9**
2	TSS	mg/l	79	7	27	6	9	**50**
3	BOD_5	mg/l	**604**	**40.8**	**35.4**	23.5	**46**	**30**
4	COD	mg/l	956	68	55	39	71	-
5	NH_4^+ - N	mg/l	**34.4**	**24**	**29.8**	**13.3**	**16.5**	**5**
6	T-N	mg/l	67.2	34.5	45.2	43.6	32.5	-
7	T-P	mg/l	16.6	9.3	1.42	2.71	6.22	-
8	Cr^{6+}	mg/l	0.04	0.06	0.09	0.05	0.06	-
9	Cr^{3+}	mg/l	0.06	0.04	0.07	0.06	0.04	-
10	Cu	mg/l	0.36	0.42	0.63	0.52	0.54	-
11	Pb	mg/l	0.0009	0.0006	0.0002	0.0004	0.0006	-
12	Zn	mg/l	0.31	0.32	0.45	0.38	0.32	-
13	Total Fe	mg/l	3.08	1.37	5.18	0.71	1.35	-
14	As	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
15	Grease, oil	mg/l	**160**	**40**	**48**	0	**210**	**10**
16	Coliform	MNP/100ml	**570,000**	**42,000**	**18,000**	**1,700**	**35,000**	**3,000**

Notes:
NT1: Wastewater at existing discharge gate (Tran Phu street)
NT2: Existing canal discharging into Cai River inthe area of the embankment in the North of the city (area of Thong Nhat Co-Operative)
NT3: Discharge gate at the end of Nguyen Khuyen street, adjacent to the railway
NT4: Existing canal in Duong De area (near Vinh Hoa 2 Primary School)
NT5: Sewers on April 2nd Street

The analysis results of wastewater quality show that the BOD_5 content exceeded the standard by 1.3 - 20.1 times, NH_4^+ exceeded the standard by 2.6 -15.3 times. The content of total grease and oil exceeded the standard by 4 - 21 times, and the content of Coliform exceeded the standard by6 -190 times in comparison with QCVN 14:2008/BTNMT-column A. The main cause of the situation is the discharge of untreated wastewater from domestic use into the environment.

2.1.4.4. Groundwater

The ESIA consultant carried out sampling on 27-28th February 2016 and took samples of the groundwater at the administrative urban center of Khanh Hoa Province (Vinh Thai Commune) on 29th June 2016. The sampling map is shown in Appendix 4. The analysis results of underground water quality are as follows based on a comparison with the standards provided in QCVN 09-MT:2015/BTNMT:

Table 2-6. Analysis results of underground water quality

No.	**Analysis parameters**	**Unit**	**Results**						**QCVN 09-MT:2015/ BTNMT**
			NN1	**NN2**	**NN3**	**NN4**	**NN5**	**NN6**	
1	pH	-	6.4	6.7	7.8	7.6	7.6	6.5	**5.5 – 8.5**
2	Salinity	‰	-	-	-	-	-	2.6	
3	Hardness	mg/l$CaCO_3$	860	300	720	340	540	-	**500**
4	TDS	mg/l	4,205	630.5	2190	929	793	2,710	**1,500**
5	$KMnO_4$ Oxidization	mg/lO_2	7.2	2.4	5.6	3.2	1.6	-	**4**
6	Cl^-	mg/l	1949	85.08	652	79.0	138.2	1,799	**250**
7	NH_4^+ - N	mg/l	3.7	0.20	0.35	3.73	0.174	5.6	**1**

8	SO_4^{2-}	mg/l	451	146	338	42.4	101	385	**400**
9	Total Fe	mg/l	10	4.8	0.26	0.6	0.7	0.89	**5**
10	Mn	mg/l	1.343	< 0.05	< 0.05	1.01	< 0.05	-	**0.5**
11	As	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	-	**0.05**
12	Coliform	MNP/100ml	0	0	0	13	0	-	**3**

Notes:
NN1: Dug well of Mr. Nguyen Bui Van's family, Xuan Ngoc hamlet, Vinh Ngoc
NN2: Well in Mr. Hoang Ngoc Anh Son's house, 142 Nguyen Khuyen, Vinh Hai
NN3: 10m-deep bored well jointly used by Group 13, De Road, Vinh Hoa
NN4: 5m-deep dug well of Ms. Pham Thi Hoa's family, Quarter 222, Cu Lao Thuong, Vinh Tho
NN5: 5m-deep dug well in Mr. Nguyen Van An's house, 283 Huong Lo Ngoc Hiep
NN6: Well water samples taken at the province's administrative urban centre (from Phong Chau Street to Quan Truong River, Vinh Thai commune)

The Cl^-contents in well water samples taken at NN1, NN3, NN6 exceeded the required standards by 1.6-7.6 times. The NH_4^+contents in the samples taken at NN1, NN4 exceeded the standards 3.7 times. The TDS contents in samples taken at NN1, NN3, NN6 exceeded the standards by 1.46-5.6 times. The Mn contents in samples taken at NN1, NN4 exceeded the standards by 2-2.6 times. The SO_4^{2-}contents at the samples NN1, NN3 exceeded the standard by 1.1 times. $KMnO_4$oxidization exceeded 1.4-1.8 times the permitted standards. The total hardness in samples taken at NN2, NN3, NN5 exceeded the standards by 1.08-1.72 times. The groundwater samples taken at NN4 showed signs of microorganism pollution, which may be caused by poor environmental sanitation, allowing pollutants from soil and stormwater to penetrate into the groundwater sources.

2.1.4.5. Soil and Sediments

The Consultant carried out the sampling of soil and sediments on 27 and 28thFebruary 2016 and measured the salinity of soil samples taken at the province's administrative urban center on 29thJune 2016. The analysis results presented in Table 2-7 below show that the indicators of the soil/mud samples taken in the subproject area meet the standards provided for in QCVN 03-MT:2015/BTNMT - National technical regulation on the allowable limits of heavy metals in the soils.

The analysis results have also shown that the salinity of sediment samples taken at Cai River area and of soil samples taken at the province's administrative urban center vary from 2.7-3.5‰, about 5-9 times the results obtained from samples taken in other areas. This shows that sediments in the area to be dredged under the subproject are salinized at a medium rate.

Table 2-7. Analysis results of soil/sediment quality

No.	Analysis parameters	Unit	Results											QCVN03-MT:2015/ BTNMT: land for public use purposes
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	
1	pH	-	5.89	6.02	6.12	6.21	6.23	6.21	6.15	6.29	6.32	6.25	6.27	-	-
2	As	mg/kg	7.2	5.4	5.26	5.18	5.18	6.35	6.58	6.42	6.28	6.73	6.84	-	**15**
3	Hg	mg/kg	0.008	0.001	0.004	0.006	0.003	0.002	0.003	0.004	0.004	0.003	0.006	-	-
4	Cd	mg/kg	1.15	1.18	1.38	1.42	1.42	1.26	1.08	1.15	1.25	1.17	1.27	-	**2**
5	Cr	mg/kg	25.6	26.2	14.6	14.2	15.8	9.3	9.27	9.24	9.63	9.27	9.48	-	**200**
6	Cu	mg/kg	42.5	40.3	38.4	36.4	34.7	40.5	41.2	45.7	40.2	45.3	43.6	-	**100**
7	Pb	mg/kg	51.4	48.7	42.5	41.7	46.5	42.8	40.6	42.8	38.6	42.5	45.2	-	**70**
8	Zn	mg/kg	148	140	131	156	148	164	152	156	149	152	143	-	**200**
9	Salinity	‰	0.38	0.36	**3.5**	**3.18**	**2.84**	**2.76**	0.52	0.4	**3.1**	**2.85**	0.51	2,7	-

Notes:
S1, S2: Soil samples taken at the area of the balancing lake at depths of 50cm and 1m
S7, S8: Soil samples taken at the area of the balancing lake at depths of 50cm and 1m
S3, S4: Mud samples taken at the area of constructing the Southern embankment of Cai river (near Ha Ra bridge) at depths of 50cm and 1m
S5, S6: Mud samples taken at the area of constructing the Northern embankment of Cai river (foot of Xom Bong bridge) at depths of 1m and 50cm
S9: Soil samples taken at the area of the wastewater treatment station
S10: Mud samples taken from the existing canal discharging into Cai river, adjacent to the area of the Northern embankment (area of Thong Nhat Co-Operative)
S11: Mud samples taken at the position where the canal is parallel to the railway
S12: Soil samples taken at the province's administrative urban center, Vinh Thai commune (from Phong Chau Street to Quan Truong River, Vinh Thai)

2.1.5 Biological Resources

2.1.5.1. Biological Resources in Khanh Hoa Province

a. Flora

118 species of lower plants of the three divisions of *Moss, Marchantiophyta* and *Bryophyta*have been recorded in the province, distributed in Hon Ba, Hon Vong Phu and Son Thai, in which Son Thai is home to the highest recorded amount with 63 species, 40 genera, and 32 families. Hon Ba is home to 52 species belonging to 28 genera and 20 families, and Hon Vong Phu has the lowest number with 30 species belonging to 21 genera and 18 families. To date, the total number of the recorded "higher plants" species reaches 2,208 species of 943 genera and 196 families. Khanh Hoa is also home to a number of endemic species such as *Deinostigma poilanei*, *Tiet Mi* in Hon Ba; *Song Qua Poilane* in Hon Ba and Son Thai. These areas are quite far from the subproject area (30-50 km).

b. Fauna

A number of new endemic animals found in Khanh Hoa include *Mytois phanluongi*, *Cyrtodactylus yanbayensis*, *Cyrtodactylus cudonggensis*, *Gecko cucdongensis*, and *Euthalia hoa*. However, they are not present in the subproject area. The number of animal species recorded in the province is presented in Table 2-8.

Table 2-8. Consolidated records of animal species in Khanh Hoa province

No.	Natural habitat	Mammals	Birds	Reptiles	Amphibians	Insects
1	Hon Ba	15	115	12	14	124
2	Son Thai – Giang Ly	6	35	4	7	-
3	Hon Vong Phu	9	5	2	12	-
4	Hon Heo	3	41	5	2	-
5	O Kha Valley	13	57	13	10	95
6	Cam Ranh Peninsula	11	67	14	10	66
7	Van Ninh	5	21	1	9	25
Khanh Hoa Province		62	341	51	64	310

Report on Current Environmental Status of Khanh Hoa Province in 2011-2015

c. Marine Ecosystem

Mangrove forests:

These are mainly situated in certain areas along Nha Phu lagoon (37.33 ha), Cam Ranh Bay (19.11ha), Van Phong Bay (17.70 ha), Vinh Truong estuary and Nha Trang Bay (15.64 ha), and Thuy Trieu lagoon (14.30 ha) with such species as *Sonneratia alba*, *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, and *Avicennia alba*.

Seagrass beds:

These are mainly situated in key areas such as Van Phong Bay, Nha Phu - Hon Heo lagoon, Nha Trang Bay, Thuy Trieu lagoon, and Cam Ranh Bay with a density of 125.6 ± 105.5 (plant/ m2), a coverage of 33.2 ± 18.9% and a biological productivity of 264.8 ± 148.3 (gram of dry seagrass/m2).

Coral reefs:

The reefs are of an average coverage of 28.0 ± 17.7%, in which rocks and long-dead corals account for a high percentage(30.4 ± 17.7%). The resources of valuable coral reef fish and large boneless bottom fauna have been much exploited, with the remaining group consisting mainly of small coral reef fish of low economic value.

These environmentally sensitive areas are quite far away from the subproject area (15-85 km).

2.1.5.2. Terrestrial Biological Resources in the Subproject Area

The subproject area has very limited natural flora and fauna due to its high level of urban development. Ecologically, the proposed subproject location is not in an area of special concern such as areas designated as having national or international importance(e.g. world heritages, wetlands, biosphere reserve, wildlife refuge, or protected areas).Consultation with the local communities and site survey results show that the subproject area is home to no endemic animals listed in the Red Book. The subproject area is mainly residential and agricultural land, household gardens, and bare land which are heavily affected by human activities. The current vegetation of the Northern WWTP area mainly includes brushwood, acacia, malabar almond trees, and coconut trees. The fauna in the area mainly include domestic animals such as chickens, ducks, dogs and cats. The flora along the Southern bank of Cai river are mainly coconut trees, nipa palms, and bamboos owned by local residents (Figures 2-2, 2-3, and 2-4).

Figure 2-2. Current status of the balancing lake area

Figure 2-3. Current status of the WWTP area

Figure 2-4. Southern bank of Cai river

2.1.5.3 Aquatic Biological Resources in the Subproject Area

There have been no official research studies on aquatic flora and fauna in Cai and Quan Truong rivers. Consultation with the local communities does not reveal any records on the appearance of rare fish or other aquatic species of concerns in Cai river and Quan Truong river. Wastewater from domestic activities along Cai and Quan Truong rivers has been directly discharged into the rivers. The river banks have been seriously encroached by shops and residential houses built

along the river together with a number of production establishments such as Son Thuy shipyard and I-resort. Therefore, this area is not a major natural habitat of aquatic species and there are no species under threat which need to be protected in the area. There has been no recorded information on fish species which need to be protected or migrating fishes in the rivers of Nha Trang city.

Site survey shows that the area mostly affected by people activities is the estuary. However, the estuary is not considered as a habitat of endangered species as well as did not have endemic species, aquaculture activities and mangroves.

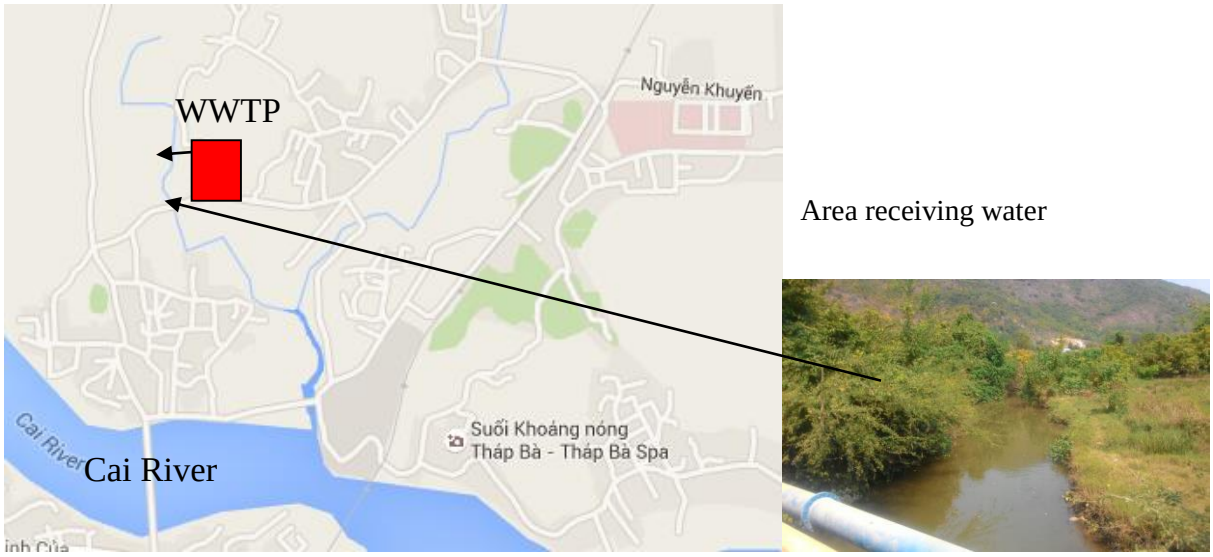


Figure 2-5. Wastewater Treatment Plant Area

a. Phytoplankton

Species composition: Samples of phytoplankton were collected in April 2016 in the area of Cai river (around Ha Ra bridge) and at the creek near the future WWTP at Vinh Ngoc commune. Analysis results show that there are 24 species belonging to 4 phytoplankton phyla at the discharge point of the WWTP and 13 species belonging to 2 phytoplankton phyla, the majority of which is diatoms, in the area of Cai river (near Ha Ra bridge).

Most of the phytoplankton identified in this area belong to the group of diatoms and are of an origin of coastal river estuaries or offshore origin: *Melosira italica, Melosira nummuloides, Skeletonema costatum, Coscinodiscus asteromphalus, Coscinodiscus jonesianus, Rhizosolenia imbricata, Rhizosolenia hyalina, Chaetoceros abnormis, Thalassionema nitzschioides, Ditylum sol, etc.* This suggests that this area is little affected by freshwater sources and mostly influenced by seawater. Only a number of freshwater phytoplankton species reach downstream to the brackish and saline water. A number of species are seen as indicators of an environment rich in nutrients including diatoms.

Quantity and dominant species: The amount of phytoplankton at the survey site varies greatly from 20 to 25,000,000 individuals per liter. *Stephanodiscus sp* prevails with 250 million cells per liter at the creek area near Vinh Ngoc commune and 244,000 cells per liter in Cai river.

b. Zooplankton

Species composition: Zooplankton samples were collected in April 2016 in the area of Cai river (near Ha Ra bridge) and in the creek near the proposed WWTP. The analysis of the zooplankton species composition yields the following data: 9 species were identified at the creek at Vinh Ngoc commune (one of which is of crustacean larval form). 30 species were identified (with 4

forms of larval) at the area of Cai river (Ha Ra bridge). In general, the species identified at Cai river area and at the creek-discharge point at Vinh Ngoc commune are mainly species distributed in the marine environment. In addition, some bottom species have risen up the water column, which may probably be due to the impacts from tides, waves and winds.

Quantity and dominant species: The quantity of zooplankton varies from 1 - 54 individuals/m^3. At the creek in Vinh Ngoc commune, the density of zooplankton is 43individuals/m^3. *Heterocypris sp* prevails witha density of 15individuals/m^3. At the area of Cai river (Ha Ra bridge), the density is 166 individuals/m^3. *Brachionus caliciflorus sp*prevails with 54 individuals/m^3.

c. *Benthic species*

Species composition: Samples of bottom animals were taken in April 2016 at the area of Cai river (area of Ha Ra bridge) and at the creek near the proposed WWTP. The analysis results show the existence of 17 species belonging to the 3 phyla of *Annelida*, *Arthropoda*, and *Mollusca*. *Annelida sp.* prevails in this species composition.

The water environment in the survey area is of brackish and saline nature. All the species collected in this area are typical of the coastal water environment.

Quantity and prevailing species: The density of collected large invertebrates varies from 10 – 2,210 individuals/m^2. *AnnelidaPolydora sp.* Prevails in samples collected at Cai river area (Ha Ra bridge), while *Oligochaeta sp* prevails in samples collected at the creek area in Vinh Ngoc commune.

Comments:

The biome structure and variations of the related aquatic species show that the water environment in Cai river - Nha Trang City has been strongly affected by a brackish to saline environment. The water is of a medium level of nutrients. In the subproject area, there are no endemic species or creatures listed in the Red Book which require protection. The subproject area, especially areas on river banks significantly affected by human activities, have no natural vegetation and no rare or typical fauna and flora.

There are a number of protected areas, mangrove forests and coral reefs in the province but these are all distant from the subproject area. Some of these are: Nha Phu Lagoon area (16 km from the subproject area), Cam Ranh Bay (40km), Van Phong Bay (approximately 85km), Nha Trang Bay (5km from the subproject area and 10km from the Northern WWTP), Hon Ba Nature Reserve (25km), Hon Mun Island (15km), and Thuy Trieu lagoon (Cam Lam district) (15km).

2.2. Socio-economic Conditions of Nha Trang City

2.2.1. Economic Conditions

2.2.1.1. Economic Structure and Growth Rate

(a) Trade - services - tourism:

Trade, services and tourism are key economic sectors which play an important role in creating the driving force for urban development and bringing about a special position for Nha Trang. Nha Trang city is a national and international tourism center and a city which is enjoying a lot of investment to become a sea ecotourism city.

The total retail sales of goods and the revenues from consumption services in 2015 reached 18,235 billion VND. In the same year, accommodation establishments received about 2,964,937 arrivals of guests. There are about 571 hotels. Revenues from tourism has been estimated at 3,530.32 billion VND, a year-to-year increase of 15.14%.

(b) Industry - Construction

The production value gained from industry – construction operations is estimated at 13,842 billion VND. 61 establishments have been set up, creating jobs for 210 laborers with an investment capital of 7,055 billion VND. Despite the rise in industrial production, goods consumption has still been slow and difficult, with large amounts of inventories in stock.

(c) Agriculture - Forestry - Fishery

Agriculture: The total area of cultivation is 1,657ha. The rice-planting area of the whole year is 1,017ha. This drop is due to serious droughts. The area of planting rice and industrial trees has been narrowed year after year to make place for carrying out various projects.

Forestry: The forest land area is about 2,768 hectares, in which the land of planted forest is 2,502 hectares, 265 hectares land of protective forest. The forest land is away 5-10km of distance from subproject area.

Fisheries: The output of catch increased and was estimated to reach 40,894 tons. The area of aquaculture reached 85ha.

(d) Construction investment

The volume of investment in basic construction from the budget was estimated at 251.52 billion VND.

2.2.1.2. Land Use

The current land use of the city is presented in Table 2-9 below.

Table 2-9. Current status of land use in the city

	Total (Ha)	Percentage (%)
TOTAL AREA	**25,259.60**	**100.00**
AGRICULTURAL LAND	**8,020.12**	**31.75**
I. Agricultural production land	**4,653.91**	**18.42**
1. Land for planting annual trees	1,593.55	6.31
** In which: land of rice fields*	*992.12*	3.93
2. Land for planting perennial trees	3,060.36	12.12
II. Forestry land	**2,768.07**	**10.96**
1. Production forest land	2,502.36	9.91
2. Protective forest land	265.71	1.05
3. Forestland of special use	0.00	0.00
III. Aquaculture land	**575.67**	**2.28**
IV. Other agricultural land	**22.47**	**0.09**
NON-AGRICULTURAL LAND	**6,320.80**	**25.02**
1. Residential land	**2,308.71**	**9.14**
** In which: rural residential land*	*943.81*	3.74
2. Land of specialized use	**3,208.73**	**12.70**
3. Religious and worshipping land	**77.69**	**0.31**
4. Cemetery land	**121.84**	**0.48**
5. River land and water surface of specialized use	**600.67**	**2.38**
6. Other non-agricultural land	**3.16**	**0.01**
UNUSED LAND	**10,918.68**	**43.23**

(Source: Statistical Yearbook of Nha Trang city,2014)

Due to a great shortage of land for building and expanding Nha Trang city, land areas by the mountains and the agricultural land funds are being converted to urban land.

2.2.1.3. Labor and Jobs

In 2014, a total of 219,156 laborers were working in various economic sectors, 66.26% of whom were trained laborers.

The number of laborers working in the agriculture, forestry, fishery and aquaculture sectors were 30,386, accounting for 13.9%. The numbers of workers in industry, handicraft and construction were 39,295, accounting for 17.9%. And those who worked in service - trade - administration totaled 149,475.

The Consultant has carried out a socio-economic survey in 18 wards/communes of the subproject with a total of 843surveyed households, including 589 households who would benefit directly from the subproject and 254 households who would be affected by the subproject.

The survey respondents were mostly hired laborers with unstable income (224, accounting for 26.7%), followed by civil servants and workers (183, accounting for 21.8%). Non-working aged respondents made up a fairly high percentage (168 people, accounting for 19.9%). People who were soldiers/policemen and other respondents accounted for the lowest percentage of survey respondents:13 (1.5%) and 12 (1.4%), respectively.

2.2.1.4. Income

Based on the ratio of poor households under MOLISA[6]standards applicable to the 2016 – 2020 period for urban areas the income rate of poor households is recorded at ≤ 900,000 VND/person/month; that of medium income households is> 900,000 VND to 1,950,000 VND/person/month; and that of well-off households is> 1,950,000 VND/person/month. In all the surveyed samples there were 86 poor households (accounting for 10.2%) with an average income of 885,458 VND/person/month, 346 medium households (41.1%) with an average income of 1,329,690 VND/person/month and 411 well-off households (48.7%) with an average income of 2,464,590 VND/person/month. The household incomes in the subproject areas disaggregated for the economic household groups are described in Table 2-10 below.

Table 2-10. Economic household groups classified by monthly income per capita

No	Ward/ Commune	Poor household		Medium household		Well-off household		Total	Rate
		Frequency	Rate (%)	Frequency	Rate (%)	Frequency	Rate (%)		
1	Vinh Hai	30	6.6	157	34.9	263	58.6	450	100
2	Vinh Phuoc	12	20.0	24	40.0	24	40.0	60	100
3	Ngoc Hiep	21	10.3	97	48.7	82	41.0	200	100
4	Van Thang	18	22.9	46	57.1	16	20.0	80	100
5	Vinh Ngoc	3	10.4	13	41.8	15	47.9	31	100
6	Others	2	10.4	9	41.8	11	47.9	22	100
	Total	**86**	**10.2**	**346**	**41.1**	**411**	**48.7**	**843**	**100**

Vulnerable households: "Vulnerable" is a term used to indicate communities or groups of people of lower political, economic or social status than the majority, leaving them more prone to neglect or breach of their rights.

[6] Under Decision No. 59/2015/QD-TTg dated 19th November, 2015 promulgating the application of a multidimensional poverty indexfor the 2016 – 2020 period

The survey results show that 68.6% of the households are not in the groups of the vulnerable households. In terms of structure, the group vulnerable households accounting for the highest percentage (26.2%) are those households with female heads. This is followed by those households having elderly and disabled people (3.9%)and households having minority ethnic members (the Hoa) (0.1%).The Hoa (Chinese) households are those of medium income. As they have long lived with the Kinh people, the Hoa do not differ much from the Kinh in customs and habits. They virtually do not face with any trouble or barriers, and can speak Vietnamese fluently. Thanks to these, the Hoa do not encounter many difficulties in developing their economy.

The group of poor households is also that with the highest percentage of female household heads with 38 households (accounting for 44.2%).In the medium household group 79 households have female heads (22.8%), and in the well-off household group103 households have female heads (accounting for 23.4%). Next is the group of households with elderly and disabled members with 31 households (3.7%). Poor households can only be seen in the poor household group with 11 households (accounting for 12.8%).

Income sources: The main income source of surveyed households is from salaries/pension (accounting for 52.9%). The income source from salaries of medium-income and well-off households accounts for the highest percentages of 48.7% in the medium household group and 59.7% in the well-off household group. The second highest income source was from trade/services with 36.8% of medium households getting income from trade/service while this ratio is 35.8% among the well-off households and 20.7% of poor households. The income source from hired jobs makes up 31.1%, and the percentage is highest (41.1%) in the poor households earning income from hired jobs.

2.2.1.5. Residential Housing

Most of the households live in solidified permanent houses (about 541 households, accounting for 64%). 221 other households live in semi-permanent houses, accounting for 26.3%. The people living in high-rise apartment buildings make up the smallest proportion of about 9 households (1.1%). 12 households (1.4%) living in garden houses are mainly poor households, and 60 households (7.2%) live in temporary houses.

2.2.2. Social Conditions

2.2.2.1. Demographics

Nha Trang city consists of 19 urban wards (Loc Tho, Ngoc Hiep, Phuoc Hai, Phuoc Hoa, Phuoc Long, Phuoc Tan, Phuoc Tien, Phuong Sai, Phuong Son, Tan Lap, Van Thang, Van Thanh, Vinh Hai, Vinh Hoa, Vinh Nguyen, Vinh Phuoc, Vinh Tho, VinhTruong, and Xuong Huan) and 8 suburban communes (Phuoc Dong, Vinh Hiep, Vinh Luong, Vinh Ngoc, Vinh Phuong, Vinh Thai, Vinh Thanh, and Vinh Trung).

According to the 2014 Statistical Yearbook of Nha Trang city, the total population of the city is 412,112 with an average density of 1,632 person/km^2, in which 200,842 are males (48.7%) and 211,270 females (52.3%). The most populated ward is Van Thanh ward with a density of 35,334 people/km^2. The natural population growth rate of the whole city is 8.84 ‰.

2.2.2.2. Education

There are totally 139 schools in the whole city from preschools to high schools with over 100,000 pupils and students, in which 54,550 children at the age of nursery schooling attend nursery schools, 32,605 children between the ages of 6 and 10 go to primary schools, and 21,950 children between the age of 11 and 14 go to lower secondary schools; 27/27 communes/wards meet national standards on primary education universalization among school-goers of the right

age and maintaining the standards of universalizing primary education and secondary education; 27/27 community learning centers have been put into operation.

Some of the universities, colleges and high schools in Nha Trang city are: the University of Fisheries; the Central College of Nursery Education No. 2; the Provincial Political Training School; the Medical Vocational School, Khanh Hoa University; the Economic Vocational School; the Vocational School; the Vocational School of Central Vietnam; Khanh Hoa Technical School, the University of Information and Communications, etc.

2.2.2.3. Health Care

There are 41 health care facilities in total in the area; 27/27 medical clinics meet national standards with 405 doctors; 100% of the medical clinics have pharmacists and midwives or conditions of providing obstetrical and pediatric care. Operations in traditional medicine have been maintained. The health care sector has made much effort in preventing the onset and outbreak of epidemics, and controlling food hygiene and safety. National health programs and objectives are fulfilled. The management and inspection of private health care have been strengthened.

In the sociological survey with the participation of 843 households in the subproject area, when being asked about the habit of drinking water, 84.9% of the households answered that they drank boiled water, 0.6% of the households would drink unboiled water, 4.9% drank both boiled water and unboiled water, and 9.5% drank water from water purifiers. Thus, there are still households with the habit of drinking unboiled water and these households account for a very small percentage of the respondents. Replying to the question on the habit of washing hands after going to the toilet, 95.6% responded that they regularly washed their hands after using the toilet, 3.8% of the respondents said, "Sometimes" and 0.6% said they did not have this habit of hand-washing. As washing hands after using the toilet is a good habit, which helps prevent infectious diseases, most of the respondents have shown relatively high awareness of taking care of their own health.

The most common diseases in the surveyed areas are flu (76.4%) and headaches (44.8%), which are common diseases in the households. Besides, other such illnesses as diarrhea (10.8%), cholera (7.1%), dysentery (7.1%), allergy (10.5%), and other diseases were mentioned by the respondents at relatively similar percentages. It is clear that those diseases and illnesses are partly caused by an unhealthy environment polluted by wastewater and waste.

2.2.2.4. Physical Cultural Resources

Nha Trang possesses a number of important tangible cultural heritages such as Dam market, the Po Nagar Cham Towers, Nha Trang Cathedral, Long Son pagoda, the Promontory, the mineral stream, Bao Dai Palace, Pasteur Institute, the Institute of Oceanography, and Tri Nguyen Aquarium. In addition, some intangible cultural heritages have been recently exploited such as the Po Nagar Festival, Am Chua Festival, Festival of the Land of Sandalwood, and the Sea Festival.

Po Nagar Cham Towers:

The Po Nagar Cham Towers are located near the proposed sewer line on April 2 street, the embankment to the north of Cai river and Chu Dong Tu street (50m from the nearest construction site). The site is a tourist favorite visit structure and has a continuing religious significance. Built between the 7th and 12th centuries, these four Cham Towers are still actively used for worship by Cham, Chinese and Vietnamese Buddhists. Originally the complex had seven or eight towers, but only four remain, of which the 28m-high North Tower, which dates from AD 817, with its terraced pyramidal roof, vaulted interior masonry and vestibule, is the most magnificent.

The towers serve as the Holy See, honouring Yang Ino Po Nagar, the goddess of the Dua (Liu) clan, which ruled over the southern part of the Cham kingdom. There are inscribed stone slabs scattered throughout the complex, most of which relate to history or religion and provide insight into the spiritual life and social structure of the Cham.

The Central Tower was built partly of recycled bricks in the 12th century on the site of a structure dating from the 7th century. It is less finely constructed than the other towers and has little ornamentation; the pyramidal roof lacks terracing or pilasters, although the interior altars were once covered with silver. There is a linga inside the main chamber.

The South Tower, at one time dedicated to Sandhaka (Shiva), still shelters a linga, while the richly ornamented Northwest Tower was originally dedicated to Ganesh. To the rear of the complex is a less-impressive museum with a few examples of Cham stonework.

An Ton Church:

An Ton church located at 2 April road, group 16, Vinh Phuoc ward, Nha trang city. The church belonged to Vinh Phuoc parish, which currently located along 2 April. An Ton church was established in 1957 and is rebuilt in 1963 and 1990. The big holidays of An Ton church include Easter, Pentecost, Assumption, All Saints and Christmas. Beside, parishioners usually go to church at 5p.m to 7.15p.m on Sunday, 4.30a.m to 5p.m on weekdays. The belief activities developed by Liturgy of the Mass, Eucharistic Adoration are to provide religious life for parishioners in the An Ton church.

Ba Lang parish:

Ba Lang Parish belongs to Nha Trang diocese (1307 Christian) and was established in 1955, and is a worship location of Jesus and Mary. The big holidays of Ba Lang Parish include Easter, Pentecost, Assumption, All Saints and Christmas. Beside, parishioners usually go to Ba Lang Parish at 5p.m to 7.15p.m on Sunday, 4.30a.m to 5p.m on weekdays.

Ngoc Thuy Vihara:

Ngoc Thuy Vihara is a local religious works, belonged to buddhism's mendicant denomination, located at no.10 Vinh Hoi, Ngoc Hiep commune, borded with South bank of Cai river. This location is next to the embankment area of South bank of Cai river. It is a worship and resting place of monks and buddhist. The belief items in Ngoc Thuy Vihara include Maitreya Buddha, Avalokitesvara Buddha, cluster of works for resting and praying and other auxiliary workrs.

Truc Lam Thien Tu Pagoda:

Located at Thap Ba area, Vinh Phuoc commune, Nha Trang city. Truc Lam Thien Tu Pagoda is next to the construction area of Chu Dong Tu road and North bank of Cai river (away 50-70m of distance from construction site). It is a local small pagoda and is a buddhism worship location of monks, buddhist. Visitors come to the pagoda mainly are local people. Truc Lam Thien Tu pagoda's holidays are 1st, fifteen day of lunar months and Vesak.

This is a crowded area with a lot of tourists and heavy traffic. Ba Lang parish is located about 50m from the proposed sewer line on Pham Van Dong Street and Duong Hien Quyen Street.

Po Nagar Cham Towers were built by Cham King Jayavarman in the years of 813 - 817. The Main Tower is for worshipping PoNagar, the symbol of beauty, art and creativity. The God of Siva and Gods of Ganeca and Sanhaka are worshipped in the other towers.	
An Ton Church 20m from construction site for stormwater and wastewater drainage sewers on April 2 Street Sensitive time: Saturday evenings, Sunday mornings, Christmas, Easter, All Saints' Day	
Ba Lang Parish stormwater and wastewater sewers in Duong 30m from construction site for wastewater drainage line on Duong Hien Quyen Street Sensitive time: Saturday evenings, Sunday mornings, Christmas, Easter, All Saints' Day	
Ngoc Thuy Vihara Close to the site for constructing the southern embankment on Cai river This is the rest place of monks, Buddhists	
Truc Lam Thien Tu Pagoda 50m to construction site on the Chu Dong Tu road, 100m to embankment construction site on the northern bank of Cai river Sensitive time: 1st and 15th days every month, Buddha Day (Vesak Festival)	
2 graves to be moved (No. 22 Vinh Hai ward)	

2.2.2.6. Gender-related issues

Participation in political bodies: Through working sessions at the 18 wards and communes of the subproject, it is noted that 8 out of 18 wards/communes have female leaders (accounting for 44.4%). However, there are almost no female local cadastral officials. Analyses show that females are still ranking lower in decision-making positions than males in local offices, which would adversely affect local women's participation in the decision-making process and their opportunities of benefiting from the subproject.

Participation in family affairs and community activities: Women still play the main role in arranging the housework work and controlling family spending. 91% of the interviewed households agree that women are the main person to take care of the housework, and to 57.6% women are house cleaners.

For the poor households, with the question "Who will decide on and pay related costs?", the answer "Both husband and wife" accounts for 55.4%, while the percentages of the answers "women" and "men" are 22.7% and 21.9%, respectively. For the medium and well-off households, the percentage for the answer "Both husband and wife" on sharing decisions on payments is higher than that obtained from poor households, which accounts for 63.3% in the medium households, 51.1% in the well-off households and 44.2% in the poor households. Thus, for important decisions in the family, there is more and more participation from both genders.

Property ownership: The percentage of females as property and land owners is lower than that of males.

More women than men participate in community activities and local organizations.

With the question on possible environmental impacts on women's health, "A lot" was given by 20.2% of the respondents; "It's normal" was the answer of 64.1%; "Very little" was given by 11.6%;, and "None" was the feedback from 4%. The above figures reveal that most of the respondents were aware of the impacts of environmental sanitation on women's health in general and public health in particular, with only a few thinking that environmental sanitation does not affect people's health and most of the respondents assessed that the impacts from environmental sanitation were at normal limits.

In general, gender equality has been observed in the subproject area regarding the making of decisions on major family issues and participating in local community activities. Females' role and status are thus heightened and appreciated. The results of the survey show that working opportunities and adaptability to job changes are current obstacles to women, especially those working in the agriculture sector at the age beyond 40. This can be minimized if local women, especially those in households affected by the subproject, have the opportunity to participate in vocational training, capacity building and communication campaigns to raise awareness of sanitation, traffic safety or social evil prevention, etc. Prioritized allocation of suitable jobs to females when implementing the subproject components would also reduce unemployment among women and help increase the income of affected households.

2.3 Infrastructure and Services

2.3.1. Traffic

- **External traffic**

Road traffic: National Highway1A: Running across the west of Nha Trang City, connecting to the former National Road 1A at Vinh Hai and Dien Khanh. The city is linked to National Highway 1A by 4 urban streets: Pham Van Dong Street from the north, April 2 Street, October 23Street from the west, and the road running through Dong Bo - Trang E area. Besides, the city

center can also be reached from the south via a road passing by Cam Ranh airport or another road crossing Cam Hai bridge. Nha Trang city has 2 external coach terminals, one located on April 2 Street and the other on October 23 Street. The subproject materials would be transported through these roads.

Railway: The Thong Nhat railway route runs across Nha Trang city for 7.5km.

Airway: The Cam Ranh International Airport is 35 km from Nha Trang city center to the south.

Waterways: Nha Trang city has several ports serving the demand of travelling by waterway. Nha Trang port is a relatively large seaport located in Nha Trang Bay. In the subproject area, there is a mooring site for a number of fishing boats along the northern embankment of Cai river.

- **Inner-city traffic**

Currently, the entire city has about 131km of streets and 74km of alleys. Most of the asphalt concrete and asphalt streets are in inner-city areas, while the crushed aggregate roads and earth roads are mainly to the north of Cai river. Most of the sidewalks in the city are very narrow (less than 3m wide), and there are no sidewalks on some streets.

Means of travel: Local people use mainly motorbikes for travelling (97%), followed by bicycles (41.5%) and private cars (5.9%).

2.3.2. Water Supply

The city had a relatively complete water supply system, including Vo Canh water supply plant (designed output of 58,000 m^3/day) and Xuan Phong water plant (designed output of 10,000 m^3/day), which use the water source from Cai river in Nha Trang with a total designed output of 68,000 m^3/day. These two plants are located 10km and 12km upstream of subproject area, respectively.

Water supply sources: Answering the question on local water supply sources, the 827 surveyed households, accounting for covering 98.1% of the interviewees, said they were using tap water and 16 households (1.9%) were using both tap water and drilled well water. According to the survey results, the rate of the households connected to the city's clean water supply system is 97.5% of the surveyed households. The remaining 2.5% said that they had not yet carried out the connection to the city's system and provided several reasons for this; yet, recurrent reasons included the high connection costs, the great distance from the pipeline, the absence of needs, etc.

2.3.3. Rain Water and Wastewater Drainage

Currently, wastewater coming from public works in the north of the city has not been collected, partly because there is no WWTP. Wastewater of hotels and restaurants is treated preliminarily only before discharging into common drainage system. The majority of the households use septic tanks but do not develop the habit of emptying these septic tanks. Construction of septic toilets in many cases failed to comply with proper specifications resulting in inadequate sanitation. 86.9% of the respondents answered that they just let wastewater penetrate into the ground or through absorbing wells.

In compliance with regulations by the People's Committee of Khanh Hoa Province, the connection to the sewer system is mandatory to households. In the stage of wastewater system connection, the households must rebuild and perform waterproofing the bottom of their septic tanks before any connection to the tertiary sewer system of the subproject.

The Northern area of the city has two main drainage axes, the eastern and western axes or drainage Line M1 and Line M2). Furthermore, there is an additional axis running along April

2street - Nguyen Khuyen, Phuong Mai ditch, and there are 5 other small axes leading to the seaside.

a)Main rain water drainage axes

a.1) <u>Eastern axis (Line M2)</u>: This line starts from Hon Kho mountain, runs through Nam Hon Kho residential area, the military area and the final point before discharging into the sea at Ba Lang sewer gate (near the head office of the People's Committee of Vinh Hoa ward). The ditch has been rehabilitated into are in forced concrete one with 3-4 m wide, under-passing Dien Bien Phu street. This axis receives water from Hon Kho mountain and Ba Lang catchments. The total length of the ditch is about 850m. As the line receives water from the ravine, its beginning section has a great declivity. Therefore, when it rains, water would rush downstream very quickly and cause flooding in many lower areas downstream. Along the ditch, there are several encroachments or plenty of bushes and grass, considerably reducing water drainage capability. In the dry season, the water flow is small but many places would be filled with waste, giving rise to stinking odor and polluting the local environment. In order to thoroughly address the problems caused by wastewater from households along the ditch in particular and from those in the area in general, the subproject will invest in building wastewater collection sewers.

a.2)<u>Western axis (Line M1)</u> : This line starts from Hon Kho mountain, runs through the southern Hon Kho residential area, crosses April 2 street passes through the field of Vinh Hai ward and Bac Vinh Hai residential area, continues across the Trans-Viet railway, and finally discharges into Cai river upstream of the railway bridge. This is a very important drainage line, as it helps ensure water drainage from the large catchment to the North of Hon Kho mountain and along the April 2 street axis of Hon Chong, Dang Tat, Bac Son, Cu Chi, Mai Xuan Thuong, Thich Quang Duc streets and AT area. In the dry season, the flow is small upstream with many places filled with waste, domestic wastewater and breeding wastewater, causing very serious pollution. In the rainy season, as it starts upstream from a very high slope, the flow would be very momentous, threatening the safety of downstream areas. The sections from Hon Kho mountain to Dien Bien Phu street and from Dien Bien Phu street to the railway are being rehabilitated. The wastewater collected from Duong De and Vinh Hoa residential areas, Ba Lang discharge gate, along April 2street, and Nguyen Khuyen street will be discharged into Line M1, where a combined sewer is built to collect wastewater to the Northern WWTP.

In addition to the drainage ditch above, the water drainage axis on April 2 street also plays a very important role in draining the majority of rainwater from the D400-D600mm sewers of Cu Chi street, the D600mm sewers of Mai Xuan Thuong street and the D400mm sewers of Bac Son street. The D600-D1500mm sewer line starting from Doan Tran Nghiep T-junction and connecting to Line M1 was constructed in the 1980s and now has shown signs of downgrading.

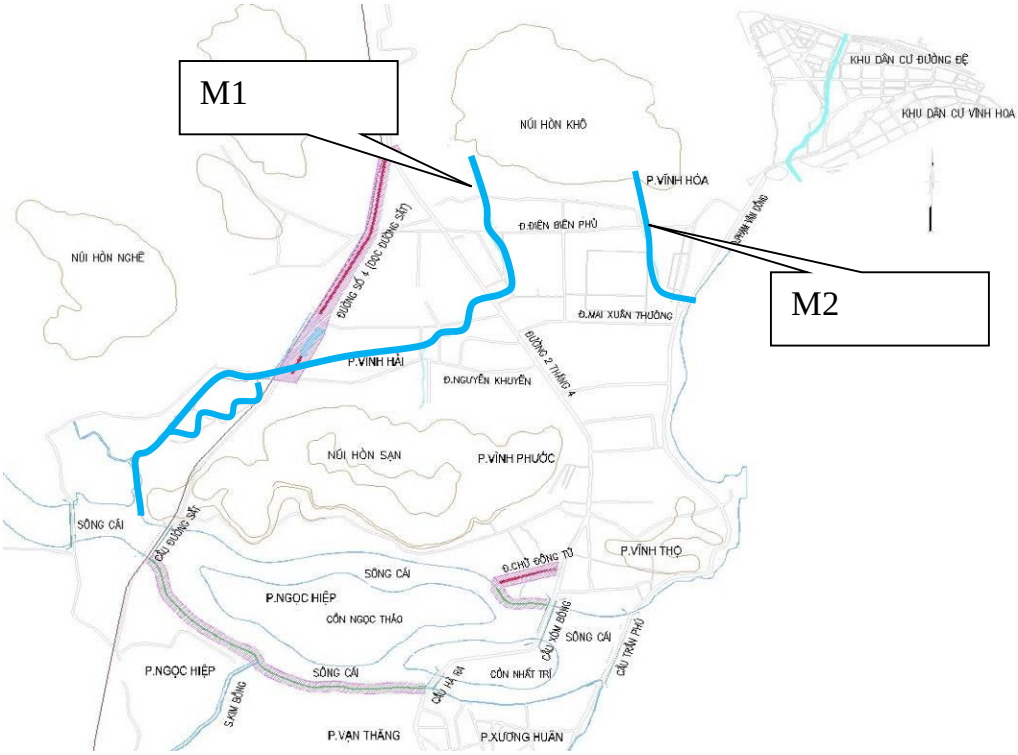


Figure 2-6. Main water drainage axes

b) Other water drainage axes

*** <u>Water drainage axis of Nguyen Khuyen street:</u>** The sewer line of D=800-1,500mm and 1,100m long starts near the T-junction of Nguyen Khuyen street - April 2 street, runs along Nguyen Khuyen street and ends by discharging into a pond at the end of Nguyen Khuyen street. This sewer line drains water in the catchment from the north of Hon San mountain to Nguyen Khuyen Street. As water is discharged into the existing pond, when it rains, the water level in the pond would be higher than that at discharge gate, considerably reducing the drainage capability of the sewer line. The subproject would propose to use a combined sewer system for this area to take full advantage of the existing sewer.

*** <u>Water drainage axis of Phuong Mai ditch:</u>** This axis collects water from Bau market area, April 2 street (section from Po Nagar Cham Towers area to Nguyen Dinh Chieu Street), Phuong Mai, and Son Thuy. As the ditch flows through crowded and unplanned residential areas, it is seriously encroached causing frequent flooding in this area whenever it rains. The subproject would build a combined sewer system along Chu Dong Tu Street to drain rain water in the whole area of Bau market and Phuong Mai ditch. The subproject would also build a combined sewer, a pumping station, and a pressure sewer line to collect wastewater from these areas.

*** <u>Discharge gates into the sea:</u>** Currently, there are a drainage gate (D1,000mm) to the final section of Cai river near Po Nagar Cham Towers and four drainage gates to the sea including (1) the discharge gate near Tran Phu bridge (D800mm), (2) the discharge gate near the Fisheries University (D800mm), (3) Hon Chong discharge gate (BxH = 2x1.6m), and (4) the Dang Tat discharge gate (D1,000mm). The subproject would build the combined sewers and interceptor sewers along the embankment road on Pham Van Dong street to separate wastewater before it is discharged into the sea.

c) Wastewater collection in residential areas

Currently, the water drainage system to the North of the city still lacks sewer lines to collect wastewater, and there is no urban WWTP in this area.Most of the drainage system isfor draining stormwater and combined sewer lines under some big streets such as April 2 street, Nguyen Xien, and Nguyen Khuyen streets in Vinh Hai Ward.

For the Duong De area, there is a system of sewers (D200-D300) along the roads in the residential areas, the sewer lines are mainly made of PVC. In addition be cause mobilization of support and communication with the local residents have not been properly implemented, most of the households have not connected wastewater from their homes to the sewer system. Instead, wastewater from households is drained mainly by letting it seep down into the ground. In compliance with regulations by the People's Committee of Khanh Hoa Province, the connection to the sewer system is mandatory to households. In the stage of wastewater system connection, the households must rebuild and perform waterproofing the bottom of their septic tanks before any connection to the tertiary sewer system of the subproject.

e) Wastewater collection catchments of the subproject

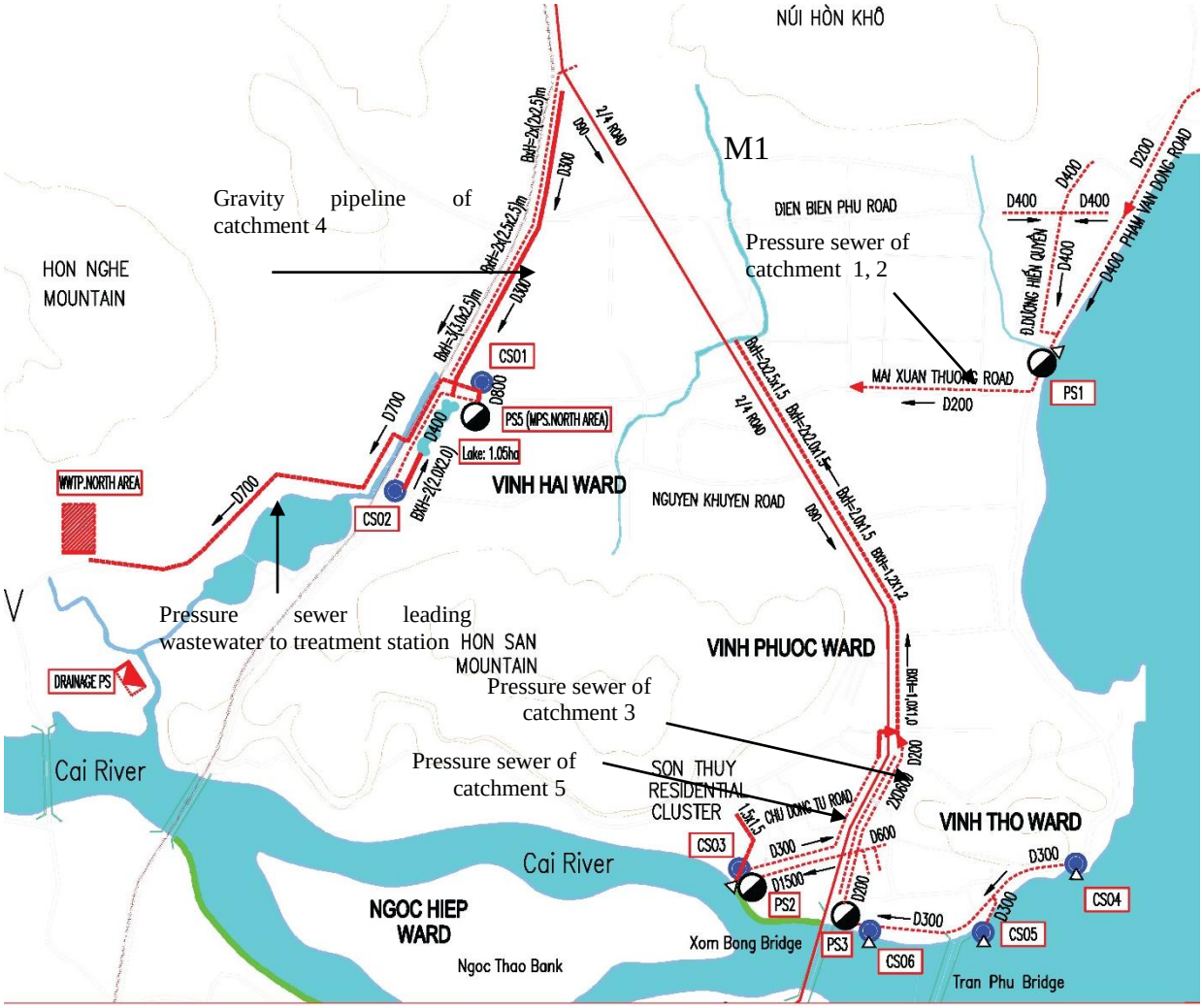


Figure 2-7. Wastewater collection areas

Wastewater from catchments 1 and 2 (Duong De residential area and Vinh Hoa urban area, and Ba Lang discharge gate), catchment 3 (discharge gate to Cai river through the gates along the embankment), catchment 4 (Nguyen Khuyen catchment), and catchment 5 would be drained into

the existing Line M1,where a combined sewer would be built to separate and collect wastewater to pumping station PS5 and then pump it to the Northern WWTP through the pressure sewer.

2.3.4. Flooding

Bau market area of Vinh Tho ward is the lowest site of April 2 street in the section from Nguyen Dinh Chieu street to Xom Bong bridge, where large volumes of rain water coming from the catchment of San mountain and La San hill. This area is currently much lower than surrounding streets with an incomplete water drainage system and slab-covered ditches of B=600mm on the two sides of the street, and water would follow Phuong Mai ditch line into Cai river. The incomplete and downgraded water drainage system often brings about flooding and inundation whenever it rains. After each rain, flood water would be 1m deep and flooding would last 5-6 hours. This is the most seriously flooded area.

The areas of Dien Bien Phu street - Nam Hon Kho residential area - SOS village are administrative divisions of Vinh Hoa, Vinh Hai and Vinh Tho wards. There have been planned residential areas such as the planning of Nam Hon Kho residential area; the planning of Bac Vinh Hai and Nam Vinh Hai residential areas, especially the ending section with the elevations from 0.4 to 1.8m. This area is significantly affected by floods from Hon Kho mountain and is frequently flooded as it rains, with a flood water depth of 0.3-0.7m and a flooding duration of about 1h.

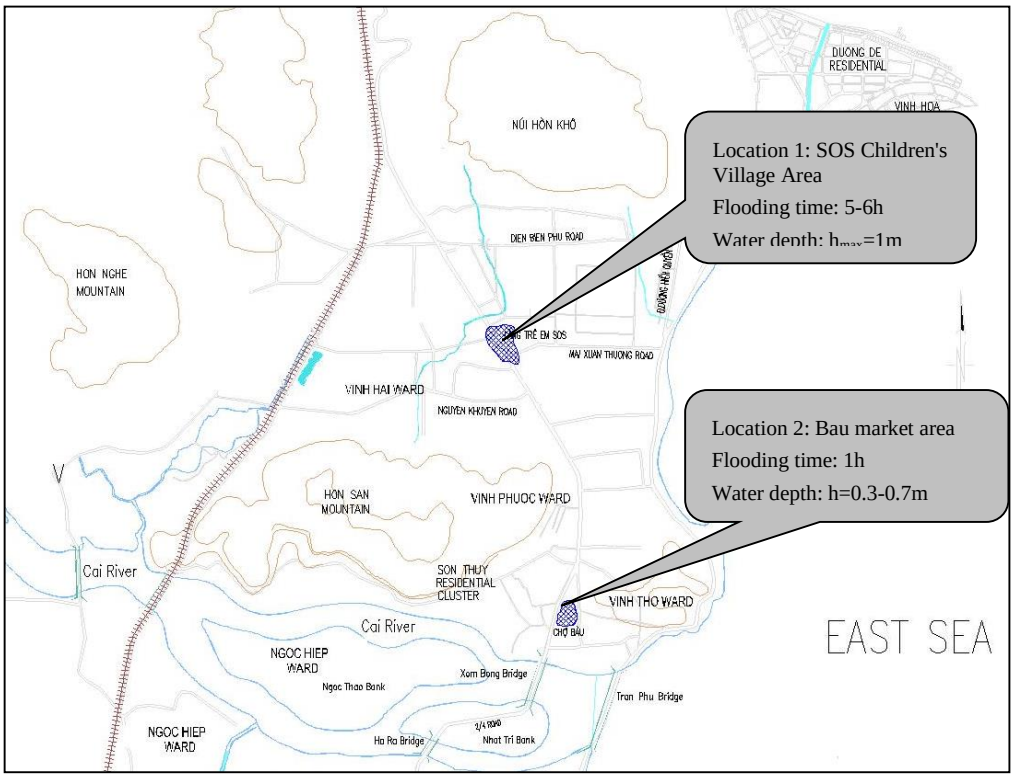


Figure 2-8. Flooding map

2.3.5. Hydraulic Works on Cai river

The sections of Cai river of Nha Trang from Tran Phu bridge to Xom Bong bridge and from Tran Phu Bridge to Ha Ra bridge have been embanked to prevent erosion and promote urban landscapes. There is no water in let or outlet in the embankment area.

2.3.6. Solid Waste Collection and Treatment

Since 2011, collection of domestic solid waste for 100% urban areas has been carried out for all the urban areas of the province. Urban environment companies and the public works management unit have collection teams to collect domestic waste at each household. In Nha Trang, the amount of domestic solid waste collected for treatment was about 120,000 tons in 2015. Before 2014, the waste dumping sites in the province failed to comply with environmental standards: there was no water proof lining and system for leachatetreatment. In 2014, 3 landfills were constructed in the province meeting the hygienic landfill standards: Luong Hoa sanitary landfill, Cam Thinh Dong landfill, and Hon Ro landfill, in service of the 3 biggest urban areas of the province.

Luong Hoa sanitary landfill with a leachate treatment system of 86 m^3/day, located in Vinh Luong commune, Nha Trang city on an area of 45 ha, was constructed under the CCESP to treat domestic solid waste from Nha Trang city. Hon Ro sanitary landfill with a leachate treatment system of 40m^3/day located in Ninh An commune, Ninh Hoa district, was built on an area of 1.4 ha to treat domestic solid waste for Ninh Hoa town. Cam Thinh Dong sanitary landfill in Cam Ranh City is located on an area of 1.2 ha and has a leachate treatment system using biological technology with an area of 2000m^2.

Treatment of hazardous medical waste: Each hospital at the district level is equipped with an incinerator for hazardous medical waste to treat medical waste from hospitals, medical centers and clinics. As there is no incinerator in Nha Trang city, the General Hospital of Khanh Hoa province uses autoclave technology to sterilize hazardous medical wastesin service of health care facilities in Nha Trang city.

As of October 2014, 2 units in Khanh Hoa province have been granted the permit to transport hazardous wastes, namely: i) Van Dao Limited Company, Khanh Hoa Branch specialized in transporting mainly oil wastes and chemical wastes of all types, and ii) Tan Thuan Phong Limited Company specialized in transporting hazardous wastes by sea vessels.

2.3.7. Power Supply and Telecommunications

Power supply: Khanh Hoa uses power from the 220 kV national grid and has standby power source from diesel generators, which can fully meet all the demands for power in production and living activities. Electricity is now supplied to 100% of the communes in the province.

Communications: Khanh Hoa uses a modern electronic switchboard system, with all districts benefiting from digital switchboards, and coverage of fixed and mobile telephone waves and the Internet in all communes. 103 out of 105 communes throughout the province provide post and telecommunication services, accounting for 98%. According to the socio-economic survey data on the subproject area, the use of cell phones reaches 88.5%.

2.3.8. Environmental and Social Conditions at Specific Subproject Locations

1) <u>Vinh Ngoc Commune</u>: Construction site of the Northern WWTP

The WWTP is proposed to be constructed on a 3.03 ha land plot, which is currently vacant land with mainly weeds and wild acacia trees. The area would be flooded during heavy rains or at high tides of Cai River (an additional 0.3m). To protect the construction site in case of flooding (with a frequency of 50 years), it is proposed that the ground should be raised to an elevation of up to 3.8m. In this area, there is a small creek connecting to Cai river. At high tide, water from Cai river would flow back into the creek, causing inundation in the area. This creek would receive the treated effluent from the proposed WWTP and then flow into Cai river (about 600-700m).

The area near the WWTP is fairly sparsely populated. The residential area is 100-300m away from the plant to the Southwest. The construction site would be 50m from a branch of Ngoc Vinh Primary School. The construction site of the WWTP would require land acquisition of existing local road and Vinh Ngoc community house. Along the existing local road, which would be acquired land, there are two water supply pipelines of I-resort and of the Water Supply and Drainage Company. These pipelines supply water to Vinh Ngoc Commune. The locations of these sensitive receptors relative to the WWTP construction site are indicated in Figure 2-9.

Figure 2-9. Relationship between the WWTP construction site and surrounding natural-social objects

(2)<u>Along April 2street</u>: The construction sites for sewers and stormwater drains along April 2 street, Son Thuy area, Bau market area; PS2, PS3 pumping stations, CS3 combined sewers. The sewer lines in this area have all been degraded and would be reinstalled.

This is a densely populated area. The drainage system is a combined sewer system, discharging all the wastewater and stormwater into Cai river. The drainage ditch along April 2 street, Bau market, Phuong Mai ditch, and the earthen ditch running through Son Thuy residential area before reaching Cai river have been degraded. The flows are narrowed by garbage and sand.

Along April 2street, there are environmentally sensitive locations such as Po Nagar Cham Towers, Bau market, and An Ton Church.

The relationship between the above-mentioned works and natural-social objects is shown in Figure 2-10 below:

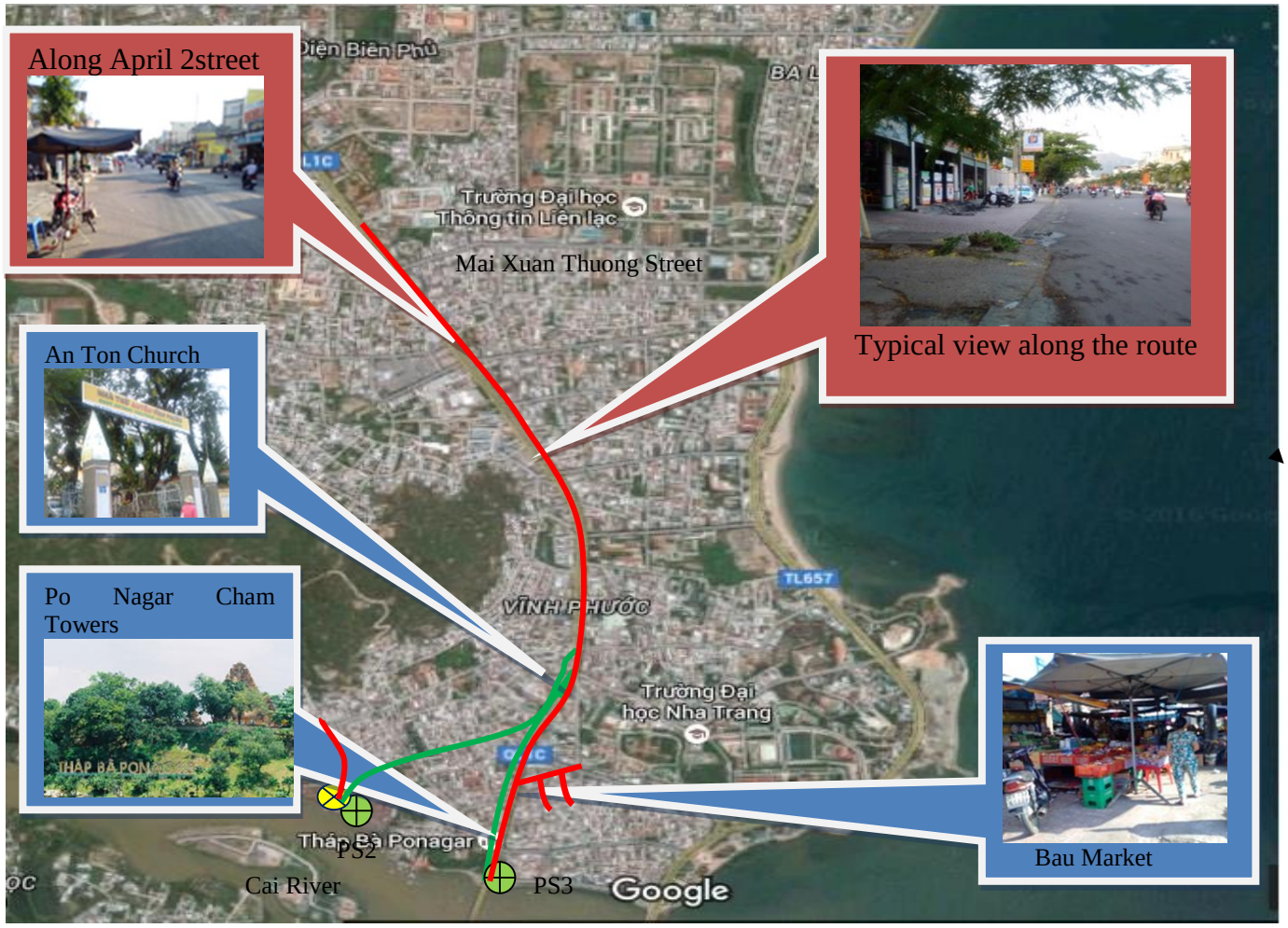
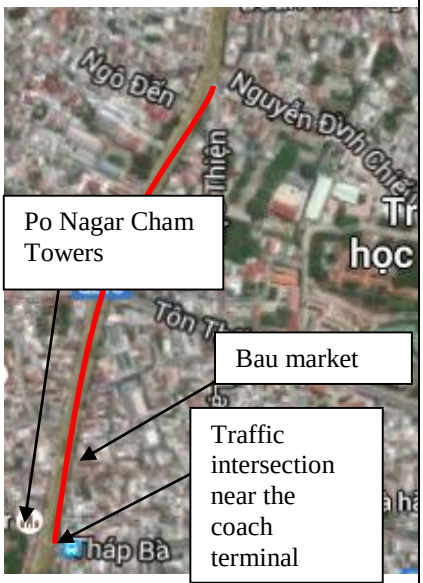


Figure 2-10. Locations of the stormwater drains and wastewater sewers on April 2street and the related natural and social objects

Table 2-11. Current status and sensitive receptors along April 2street

No.	Item	Current status	Typical views
Drainage system on April 2street			
1	Box culvert(1x1(m) to 2.5x1.5 (m)) on April 2street, from Doan Tran Nghiep street to Line M1, L=1,687m, depth = 1.7-2.4m	- Densely populated area with heavy traffic; mainly small businesses; green trees along the street	
2	Sewers (D600-D800) on April 2 street from Thap Ba street to Nguyen Dinh Chieu street (on both road sides) L=1,386m, depth = 1.3-1.8m	- Densely populated area with heavy traffic; starting point being the intersection near the parking area of Po Nagar Cham Towers - Sensitive receptor: Bau market located near April 2 street and the Po Nagar Cham Towers 	
3	Sewers (D600, D1,000) from Bau market (starting point intersecting with April 2street), L=375m, depth =1.4-2.7m	- Located inside the market regular large crowds - Ditch system damaged - Bau market: area affected by flooding	
Wastewater sewer system on April 2streetarea			
5	Pressure culvert (D200) from PS3 (foot of Xom Bong bridge) to April 2street (Doan Tran Nghiep T-junction), running along April 2street, L= 808m, depth = 0.9-3.3m	- Densely populated area with heavy traffic along April 2 street; small roads - PS2 pumping station area near car park beneath Xom Bong bridge - Sensitive receptor: the Po Nagar Cham Towers along the Northern bank of Cai river	
6	Pressure Sewer (D200) from PS2		

No.	Item	Current status	Typical views
	in Son Thuy residential area to April 2 street, L=871m, Depth = 1m		
7	PS3 pumping station: Cai river embankment	- Vacant land - Foot of Xom Bong bridge - Construction area: 45 m^2 - Near the car park of Po Nagar Cham Towers	
8	PS2 pumping station: Son Thuy residential area	- Planned sidewalk at T-junction of Cai river embankment – Chu Dong Tu street; - Area:45 m^2 - Vacantland owned by the Ship Building factory located 20m from the river	

(3) <u>Area along the embankment - Pham Van Dong Street:</u> The investment items would be the interceptor sewers (D300) along the embankment, CSO4, CSO5, CSO6 combined sewers.

This is a densely populated area, especially with a large number of hotels and restaurants along Pham Van Dong street. Rainwater and wastewater are mainly drained into the existing sewer system. There are 4 discharge gates into the sea: one near Tran Phu bridge, one near Ton That Tung street, Hon Chong discharge gate, and one on Dang Tat street. There are no signs of erosion at the discharge gates but wastewater discharged into the sea produces ill smell. The combined sewers are positioned on the sidewalk, with an area of 2 m^2. Two bridges crossing this area are Tran Phu bridge (near CSO5) and Xom Bong bridge (near CSO6).

Figure 2-11. Area along the embankment – Pham Van Dong

(4) <u>Area along the railway (from Nguyen Khuyen intersection to April 2street intersection)</u>: The proposed investment items in this area include **c**onstruction of road No. 4, the balancing lake and box culverts parallel to the railway; sewer connecting Nguyen Khuyen discharge gate to the balancing lake; PS5 pumping station, pressure sewer from pumping stations to the WWTP.

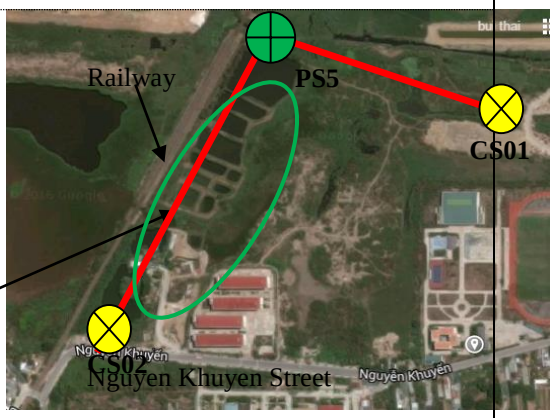
According to land use planning, this area is reserved for urban development. Currently, the area is sparsely populated, mainly of vacant land with bushes and weeds in the middle. The main drainage line runs along Nguyen Khuyen street, then crosses the railway bridge and connects to the main ditch No.1.

Environmentally sensitive receptors near the area include: the railway that runs along the proposed Road 4, 2 graves which need relocation (near the area of Nguyen Xien street).

Table 2-12. Current status and sensitive receptors along the railway

No.	Items	Current status description	Typical image
1	Road No.4 – along the railway (including box culverts along the road, with dimensions from 2mx2.5m to 3mx2.5m) from Nguyen Khuyen intersection to April 2street intersection L=1,828m	- Road would be located along the railway with the road edge 15m away from the railway slope - Mainly bushes and weed along the road Environmental sensitive locations: - Intersection between Nguyen Khuyen street and the railway (the starting point) - Intersection between the railway and April 2street (the ending point) - Intersection between Nguyen Xien street and the railway - Route mainly running through vacant land or people's housing next to the railway.	
2	Culvert D90 from April 2 street to Road No.4 with the length of 37m		
3	Construction of box culvert 4x(2x2.5)– Vinh Hai ward L= 120m	- Area where Nguyen Khuyen street intersects with the railway - Close to the railway	 

No.	Items	Current status description	Typical image
5	Construction of sewer 2x (2x2) m , connecting Nguyen Khuyen St. discharge gate to the balancing lake L=259m	- Vacant land - Currently with mainly wild trees, weed, water ferns, and stinking wastewater ditch 	
6	Pressure sewer (D700) from PS5 to Northern treatment plant, L=1,773m	- Sewer section from pumping station would cross the railway - Trees and weeds on both sides of the road	
7	PS5 pumping station (main PS of the Northern area)	- PS5 located in this planned area for greenery and balancing lake in Vinh Hai and Vinh Hoa wards - Currently vacant land - Construction area: 2,145m2 near balancing lake	 Vacant land with bushes and weeds

No.	Items	Current status description	Typical image
8	Interceptor sewer (D400) from CSO2 combined sewer to PS5 pumping station L=543m	- From the end of Nguyen Khuyen street near the railway to balancing lake - Existing wastewater ditch - Vacant land with weeds and water-ferns 	
9	Interceptor sewer (D800) from CSO1 combined sewer to PS5 pumping station L=76m	- Vacant area mainly covered with weeds - Starting from CSO1 combined sewer at the end of M1 ditch (Phu Xuong) ditch to PS5 pumping station towards the railway	
10	Construction of balancing lake on 1.05 ha in the East	- Lake located in Vinh Hai ward - Currently vacant - Located near the railway - Proposed area for lake and pumping station covered mainly with weeds and morning glory, stagnant with wastewater from Phu Xuong area 	

(5) <u>Duong De – Vinh Hoa residential area and Ba Lang discharge gate area</u>: The construction area of the sewer systems, PS1 and PS4 pumping stations.

Duong De and Vinh Hoa residential area: This is an area with a relatively complete sewer system, including both a rainwater collection and drainage system and a wastewater collection sewer system; however, water from both systems is discharged into the existing open ditch before discharging into the sea.

Ba Lang discharge gate area: the main drainage route is ditch No. 2 which has been completely constructed. All rainwater and wastewater are discharged into Ba Lang discharge gate before going the sea.

Environmentally sensitive sites in the area include: Market at Duong Hien Quyen- Dien Bien Phu intersection (adjacent to the construction site), Ba Lang Parish at Duong Hien Quyen - Pham Van Dong T-junction (20m from the construction site), Vinh Hoa Primary School 2 on Ngo Van So street (toilet construction site), Mai Xuan Thuong Secondary School on Mai Xuan Thuong street (close to the construction site of sewer system).

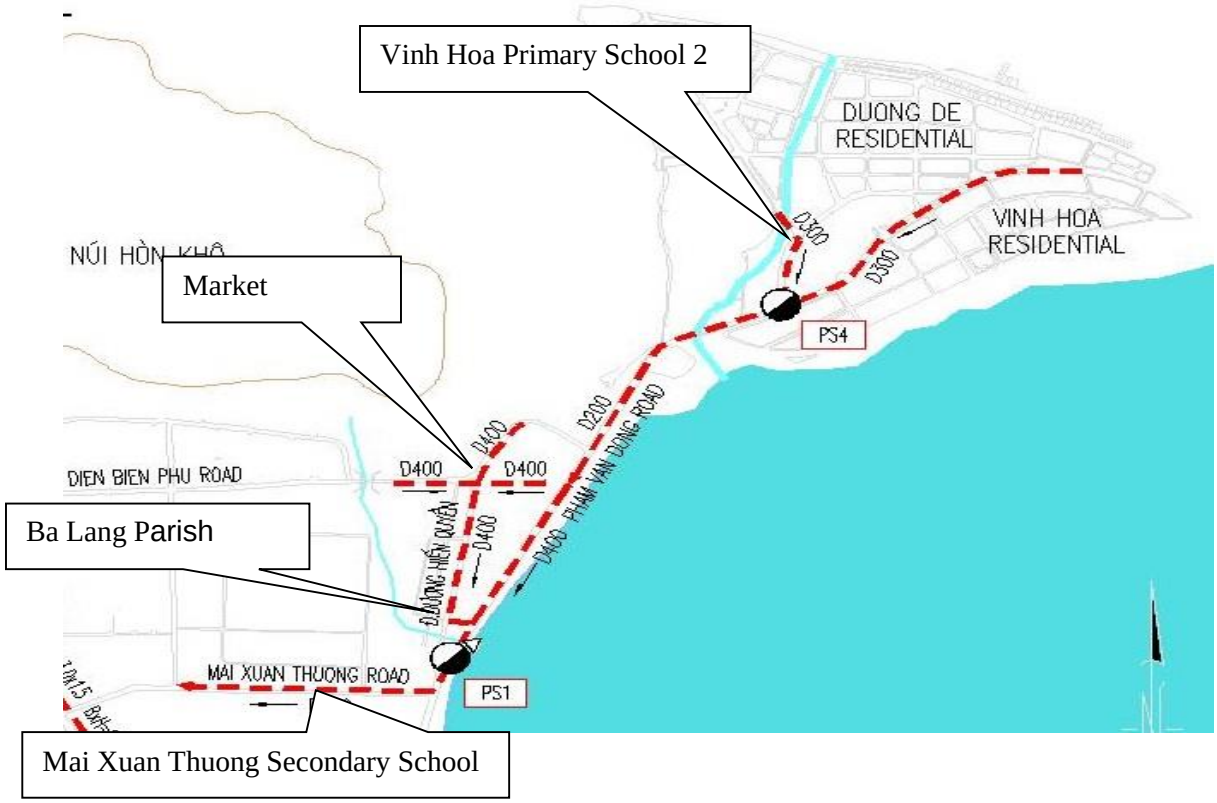


Figure 2-12. Map of current status of Duong De area

Table 2-13. Current status and sensitive receptors in Duong De – Vinh Hoa – Ba Lang Areas

	Item	Sensitive location	View of sensitive location
1	Gravity sewer (D300) in Duong De residential area along Pham Van Dong Street L=1007m	- Business stores - Vinh Hoa Primary School 2 (Duong De residential area), 30m from Pham Van Dong Street	

2	Pumping Station 4: construction area of 45m^2	- Duong De residential area, located on the sidewalk of Than Nhan Trung street, 25m from Than Nhan Trung – Pham Van Dong T-junction - Small business stores	 Sparsely populated, light traffic
3	Pham Van Dong Street - pressure sewer (D200) from PS4 (Duong De residential area) to the gravity sewer pipeline, L=924m	Mainly business stores along the street; medium traffic Environmental sensitive locations: - Crowded market at Duong Hien Quyen – Dien Bien Phu intersection; - Sao Bien Nursery School on Duong Hien Quyen Street (20m from site); - Ba Lang parish at the end of Duong Hien Quyen street (intersecting with Pham Van Dong street) - Mai Xuan Thuong Secondary School 	
4	Dien Bien Phu Street - gravity sewer (D400), L=383m		
5	Dien Bien Phu Street - sewer (D1000), L=900m		
6	Duong Hien Quyen Street – gravity sewer (D400), L=863m		
7	Pham Van Dong Street (Dien Bien Phu T-junction to PS1), sewer (D400), L=431m		
8	Pressure sewer (D200) from PS1 to Mai Xuan Thuong combined sewer, L=749m		
9	Pump station No. 1at Ba Lang discharge gate	- Sidewalk of Pham Van Dong Street, 4m from existing box culvert (M2) towards Mai Xuan Thuong T-junction, area: 45m^2, current land use: sidewalk land	 Light traffic, households along the roadside mainly running small businesses

(6) Areas along the Northern and Southern banks of Cai River: The construction of roads, Northern and Southern embankments of Cai River, Chu Dong Tu street.

This is a densely populated area, with households located along the banks of Cai River, the majority of which are poor households with low living conditions. The residents often discharge wastewater and garbage directly into the river, polluting the river and estuary environment. In

addition, the areas on the two banks of the river are usually flooded, especially in recent years, due to the impacts of urbanization and climate change. The river section in the study includes several bridges: the railway bridge (or Ngoc Hoi bridge) upstream (220m), Xom Bong bridge (318m), and Ha Ra bridge (137m), and Tran Phu bridge (458m) at the final section, close to the river's mouth. Besides, there are two other small bridges: a small bridge giving access to Ngoc Thao is let and the Hai Dao bridge.

Environmentally sensitive locations in this area include the Po Nagar Cham Towers (on the northern bank of Cai river), 50m from the construction site and, Ngoc Thuy Vihara (adjacent to the southern bank of Cai river).

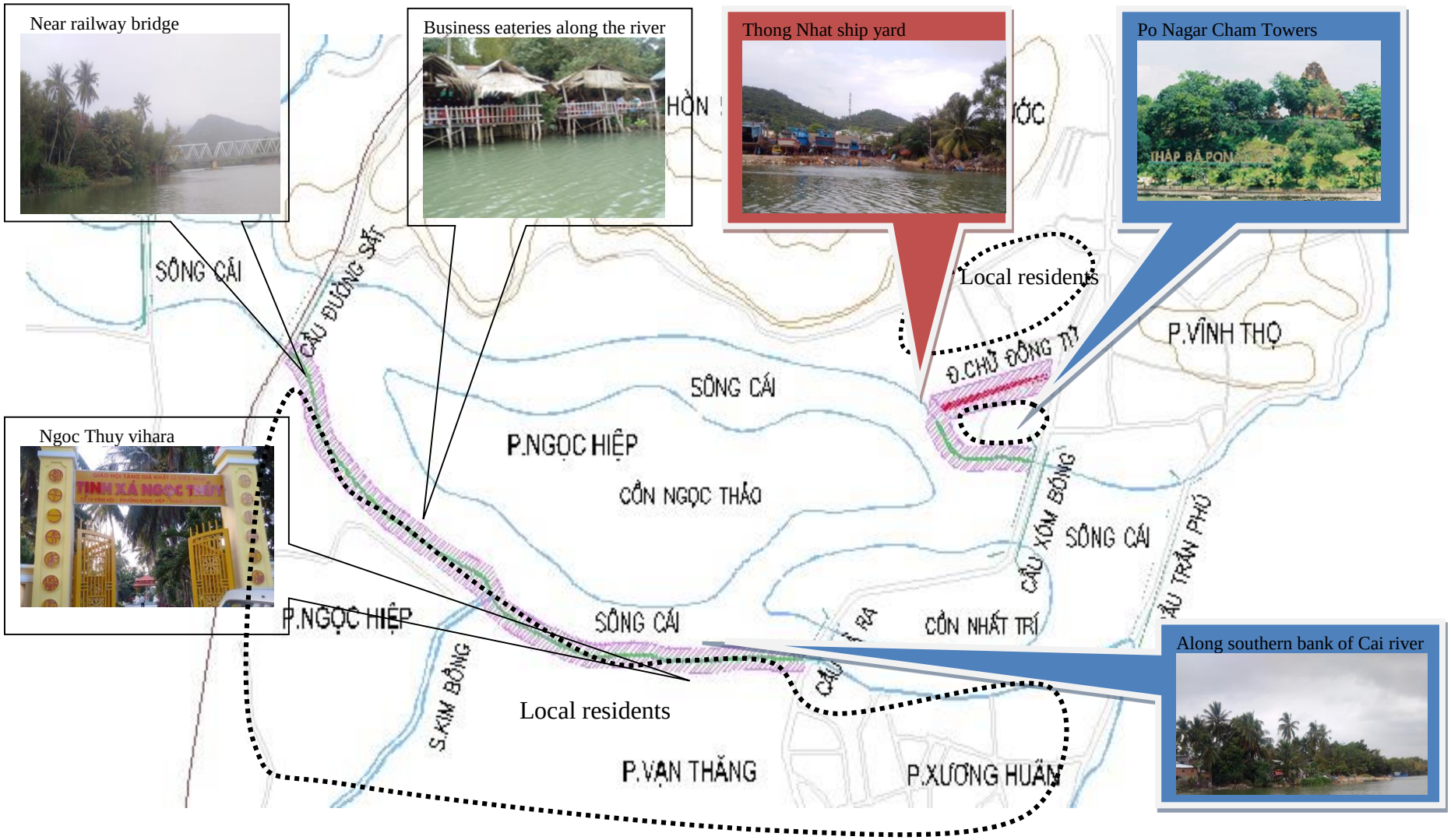
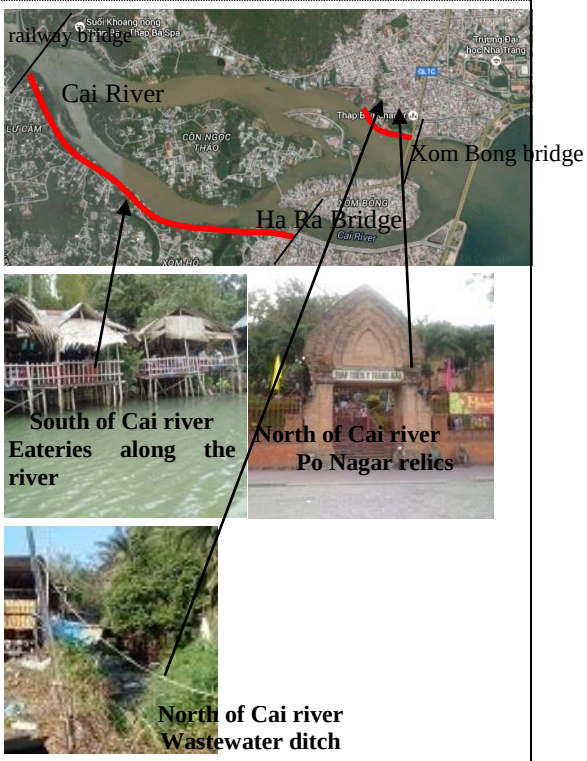


Figure 2-13. Map of the current status along the Northern and Southern banks of Cai river

Table 2-14. Detailed description of the northern and southern banks of Cai River

Item	***Sensitive location***	***View of sensitive location***
1) Dike and embankment; road on the Southern bank of Cai river from the railway to Ha Ra bridge	- This is an estuary area, with a densely populated area of the southern bank of Cai river. Residents run mainly restaurants, eateries and catering services by the river edge. Riverside vegetation includes mostly coconut palms, bamboo, and some other crops planted by residents. - Erosion takes places more and more, especially in recent years in the area from downstream the railway bridge to Nhat Tri islet, posing a threat to residents' housing. - Heavy traffic with high risks of traffic jam. - Environmental sanitation is poor because of wastes directly dumped from riverside business households into the river.	
2) Dike and embankment; road on the northern bank of Cai river from Xom Bong bridge to Chu Dong Tu street	- The area is currently a mooring place of some local residents' small fishing boats. The construction area for the embankment and road is adjacent to the relics of Po Nagar Cham Towers. There is a sewage ditch discharging water directly into the river section in Son Thuy shipyard area. - The environmental sanitation is poor. - Heavy traffic with likely traffic jams and accidents.	
3) Chu Dong Tu street (including box culverts along the road)	- This is a densely populated area with small internal roads and heavy traffic. - The area is located near the Po Nagar Cham Towers frequented with many tourists. - This is an area with very heavy traffic.	

		 **North of Cai river Existing ditch**

Table 2-15. Current status of toilets at schools

Toilets in Vinh Hai 2school (Nguyen Khuyen street)	The classroom blocks are of Grade IV structure and are expected to be replaced with the new classroom blocks. The land fund for the construction of toilets is relatively substantial. The existing toilets have been degraded. 
Toilets in Vinh Hoa 1 Primary School (Dien Bien Phu street)	The classroom blocks are two-storey buildings. The land fund for construction is relatively substantial. The existing toilets were constructed long ago and have now been degraded. 
Toilets in Vinh Hoa 2 Primary School (Ngo Van So street)	The classroom blocks are two-storey buildings. The land fund for construction is relatively substantial. The existing toilets are not sufficient for the school's large number of pupils.  
Toilets in Vinh Tho Primary School (Ton That Tung street)	The classroom blocks are two-storey buildings. The school has 01 toilet area which is now degraded and is not sufficient for the school's large number of pupils (800). The new toilets would be constructed on the ground of the existing toilet area.

CHAPTER 3. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT AND FORECASTS

3.1. Positive Impacts

Enhancement of wastewater collection and treatment capacity, contributing to effectively addressing flooding and environmental pollution

Component 1 would enhance the capacity of the Southern WWTP through additional investments in completing the network of tertiary sewers and odor-preventing manholes in the central and southern parts of the city so as to basically to collect and treat the wastewater for these areas.

This Component would help resolve flooding and environmental pollution in the Northern part of the city through investments in sewers, odor-preventing manholes, pumping stations, balancing lake, and the Northern WWTP.

At the same time, the construction of the new balancing lake would contribute to creating a microclimate, enhancing environmental landscapes, increasing the area's humidity, and creating favorable conditions for the vegetation to grow and develop, thus bringing about positive impacts on the environment around the balancing lake.

Enhancement of flood drainage and landslide prevention on both banks of Cai river

Dikes and embankments constructed under the subproject coupled with upgrading of the traffic infrastructure would help increase flood drainage and landslide prevention on both banks of Cai river meeting the development demands of the city.

Positive impacts on community health

The subproject would improve sanitation conditions in the area, contributing to the better local people's living environment, reducing pollution and water related diseases, and hence enhancing their health. Communication on hygienic water and sanitation would help the school children change their behavior toward healthy water and sanitation habits for the better health and development.

Guarantee of post-subproject technical and financial sustainability

The technical assistance given to the subproject owner, management agencies and sectors' institutions would help bringing about efficiency in the operation promotion the subproject sustainability.

3.2. Potential Negative Impacts and Risks

The construction activities likely to exert potential negative impacts on the environment include:

- Land acquisition and site clearance;
- Mobilization of workers and machinery
- Construction and operation of temporary worker camps;
- Removal of the top soils; ground-leveling for the WWTP, balancing lake and pumping stations;
- Transporting and gathering materials
- Casting sewers and piles;
- Soil excavation, riverbank dredging;
- Construction of works or installation of equipment items;
- Backfilling, finishing, and site reinstatement;

- Waste disposal.

The types and nature of impacts may change significantly in conformity with the characteristics and the scale of activities, locations and environmental and social conditions, human habits and time elements. In general, however, all the activities of all relevant construction items are related to medium-sized construction works, in which most of the negative environmental impacts are temporary, localized and able to be modified and mitigated through the application of suitable technology and construction management measures, close supervision on the performance of contractors and consultation with local communities. The details of the impacts will also be presented in this chapter.

The potential impacts of the subproject components may be classified in terms of level as follows: 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. Level of negative impacts from subproject implementation

Work items	Physical elements			Biological elements		Social elements				Others		Notes
	Air, noise, vibration	Soil, water	Solid waste, dredged sludge	Forest, natural ecosystem	Fish, aquatic species	Land acquisition, resettlement	Native ethnic groups	Tangible culture resources	Livelihood, disturbance to residential community	Localized flooding, traffic, safety	Impacts from outside subproject area	
Storm water and wastewater pipelines, CSOs, balancing lake, stormwater and wastewater pumping stations												
Preparation	L	N	N	N	N	M	N	N	L	N	N	- Small and medium scale works with small impacts (see Notes (2) below for further information)
Construction	M	M	M	N	N	N	N	L	L	M	L	
Operation	L	N	L	N	N	N	N	N	N	L	N	
Northern and Southern embankments of Cai river												
Preparation	L	L	L	N	N	M	N	L	M	N	L	- Large-scale works with significant impacts (see Notes (2) below for further information)
Construction	M	M	M	L	L	N	N	L	M	M	L	
Operation	N	N	N	N	N	N	N	N	N	N	N	

Traffic roads												
Preparation	L	L	L	N	N	M	N	L	M	L	N	- Medium-scale works with medium impacts (see Notes (2) below for further information)
Construction	M	M	M	N	N	N	N	L	M	M	L	
Operation	M	N	N	N	N	N	N	N	N	L	L	
Wastewater treatment plants												
Preparation	L	L	L	N	N	M	N	N	L	L	L	- Medium-scale works with medium impacts (see Notes (2) below for further information)
Construction	M	M	M	N	N	N	N	N	M	M	L	
Operation	L	L-M	M	N	N	N	N	N	L	L	L-M	

Notes: (1) The following criteria are used to assess the level of impacts: 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, able to be mitigated and managed, localized, temporary; High (H) – Medium-scale works in small sensitive/urban areas, large-scale works with significant impacts (social and/or environmental), many of which are irreversible and require compensation. Both M and H require monitoring and implementation of mitigation measures as well as an appropriate institutional capacity in terms of safety.

(2) Most impacts of small and medium scale works are localized and temporary and can be mitigated through the application of technical solutions and good construction management practice with strict supervision, inspection and consultation with the local community.

A. COMPONENT 1

A.3.2.1. Pre-construction Stage

A.3.2.1.1. Impacts of Land Acquisition And Site Clearance

Impacts of land acquisition

According to the statistics of assets affected by land acquisition for Component 1: The total land area permanently acquainted would be 51,903.3m^2, in which: 3,893.2 m^2 of residential land; 32,269m^2 of agricultural land; and 8,741 m^2 of traffic, irrigational and unused land. The subproject would affect the agricultural land for annual crops in the following areas: 26,497m^2 at the WWTP (Vinh Ngoc ward); 1,126 m^2 at the stormwater pumping station (Vinh Ngoc ward); 2,799 m^2 for the road in front of the WWTP; 8,847 m^{2}for construction of the pressure pipeline to the WWTP (Vinh Ngoc ward). The traffic land at the following areas would be affected: 1,789m^{2}for the road in front of the WWTP (Vinh Ngoc ward); 815 m^2 at the pressure pipeline D700 to the Northern WWTP (Vinh Hai, Vinh Ngoc); and 3,246m^2 at the stormwater pumping station.

80 households, Vinh Ngoc Ward Community House (near the WWTP), and Vinh Ngoc Primary School (near the WWTP) would be affected. Among the affected households, 16 households would be displaced, 22 households would be seriously affected by land acquisition of over 20% of production land area (10% for poor and vulnerable households) in the area of the Northern WWTP.341 m^2(or 6%) of the total of 5,588 m^2 of the Vinh Ngoc primary school will be acquired, including part of the schoolyard and the fence. The whole Community House of Xuan Ngoc hamlet and its land (2,828 m^2) will be acquired for construction of the WWTP.

The resettlement demand of Component 1 based on construction components is as follows (Table 3-2):

Table 3-2. Resettlement demand in Component 1

No	Item	Households	Person	Resettlement lot
1	Northern WWTP	12	65	30
2	Drainage, flooding control, and wastewater collection	04	12	08
	Total	16	77	38

This resettlement demand is based on survey and consultation results in February 2016 for the households to be displaced. Although 16 households would be displaced, 38 resettlement lots of land would be needed in case of household splits.

Social impacts on displaced households:

The households to be displaced and resettled would likely to undergo psychological troubles and changes in their social relations. It would take them some time to adapt to the new environment with new conditions and access to the new services such as health care, markets, schools, etc. Other social relations would develop owing to the displacement to novel living places. Under Component 1, the number of households to be displaced would be relatively small (16). These households will be resettled in the resettlement sites of Ngoc Hiep and Hon Ro, which are 2-5km from the city center and conveniently accessible by traffic roads. The resettlement sites are currently being constructed with all infrastructure bases such as power supply, water supply and drainage, health care clinics, markets, and schools within short

distances of 0.5-2 km. Daily life activities for resettled households will therefore be secured. So the impact is at a medium level.

Impacts on households losing production land (agricultural land):

The households losing production land would be affected in terms of income and livelihoods. With a local population depending much on agricultural activities for a living and on highly seasonal job opportunities, low qualifications and the lack of skills will further limit their ability to find non-agricultural jobs so as to generate incomes. The people who may suffer from the adverse impacts or be exposed to the risk of further impoverishment due to the loss of production land include: (i) female household heads (single, widowed or with husbands incapable of working) having dependents, (ii) people with disabilities and helpless elderly people, (iii) poor people in accordance with the criteria of the Ministry of Labor, Invalids and Social Affairs, and (iv) people without land. However, the main income of the affected households (10 households in the WWTP area) does not come from agricultural production, but from being hired or doing other seasonal jobs. In addition, the subproject would not affect their seasonal job opportunity. Therefore, this impact level is assessed to be moderate. The subproject will provide assistance in livelihood restoration and training for income losers, especially vulnerable subjects.

For Vinh Ngoc Hamlet Community House which will be totally acquired, the main impact is the residents' temporary loss of a common place for community activities. However, as this is a newly built community house, and the locality has agreed to receive compensation in cash and construct a new community house at another place. The community will need to find another temporary place to have the community meetings and events. Therefore, the impact is assessed as low.

For Vinh Ngoc Primary School, partial acquisition of the school yard and fence walls would cause the loss of some playing ground for the pupils.

No land acquisition or resettlement would be required for construction of the tertiary sewers, drainage, flood prevention and wastewater collection system, balancing lake, main pumping station in the North PS5, CSO 01 and interceptor sewer (D800) connected from CSO 01 to PS57, and the school toilets. The statistical data of impacts by Component 1 are provided in Table 3-3.

Table 3-3. Statistics of impacts of land acquisition

No	Item	Pressure pipeline D700 to the Northern WWTP	Reinstated road in front of Northern WWTP	Cai river pumping station	Northern WWTP	Total
1	**Total affected area**	9,945.6	4,809.6	5,490.1	31,658	51,903.3
1.1	Livelihood land	283.6	221.8	1,100.1	2,287.7	3,893.2
1.2	Agricultural land	8,847	2,798.8	1,126	26,497	39,269
1.3	Traffic land	815	1,789	3,264	2,873	8,741
2	**Affected works (m2)**					
2.1	Houses	748	0	0	1,977	2,725
2.2	Grave	0	0	0	0	0
2.3	Other	76.2	0	0	196.3	272.5
3	**Affected crop (tree)**					
3.1	Annual crop	0	0	0	196	196
3.2	Perennial crop	1,571	471	314	1,375	3,731

[7]Item: CSO 1 , interceptor sewer from CSO 1 to main PS in the North, balancing lake in the east (2ha), sewer connecting Nguyen Khuyen outlet to balancing lake in the east under Nam Vinh Hai subproject approved by the PPC in Decision 1525/QD-UBND dated 15 June 2011.

4	**Total affected house (household)**	40	12	10	18	80
4.1	Displaced households	4	0	0	12	16
4.2	Affected business household	0	0	0	0	0
4.3	Severely household	10	4	2	6	22

A.3.2.1.2. Safety Risks of Unexploded Ordnance

The subproject construction sites have been much affected by human activities, and unexploded ordnances (UXOs)have already been cleared. Experiences in implementation of the CCESP in Nha Trang city show that no UXOs have been detected before and during construction. However, this risk needs to be considered due to its high severity which would cost human lives and properties. The construction sites under Component 1 such as the areas for the WWTP, storm water pumping stations, and balancing lake may face possible risks of UXOs. Therefore, UXO detection and clearance must be carried out before commencement of any construction work.

A.3.2.2. Impacts During Construction Phase

A.3.2.2.1. Air Pollution

Air pollution from dust, exhaust gases, and noise mainly comes from such operations as demolition of works, ground leveling, excavation and backfilling, as well as transportation.

a) Dust and exhaust gases

Air pollution and dust caused by demolition:

As the construction site for the balancing lake is vacant land with no construction works and no residential households around, there will be no impact from dust that might otherwise cause air pollution due to dust form demolition operation.

In the construction site for the WWTP, the fence walls of Vinh Ngoc Primary School, the Community House of Xuan Ngoc hamlet, and 12 houses will have to be demolished. With both relatively small demolition volume and fairly sparse population in the area, air pollution from dust is assessed to be low.

As for the construction of school sanitation blocks, demolition work would be limited to the existing toilets only. Exhaust, dust, and noise created by the dismantling activity and removal of debris can affect the pupils present at school, causing dust nuisance and distraction. However, given the small scale of this activity, the impact can be assessed as low.

It could be concluded that impacts from dust and air pollution generated by the demolition of works are temporary, localized, of small scale, and controllable.

Air pollution caused by ground leveling, excavation and backfilling, and transportation:

Dust and exhaust gases will be dispersed from the processes of ground leveling, excavation, backfilling, and stockpiling and transportation of materials.

- Dust from ground leveling, excavation and backfilling: On average, dust generated from excavation or backfilling of 1m^3 of earth would be about 0.75 kg /m^3, of which 10% is suspended dust. Based on pollution coefficient E = 0.075 kg/m^3 and compliance with the subproject work progress, the loads of dispersed dust generated by excavation, backfilling and ground leveling can be forecasted as follows (Table 3-4):

Table 3-4. Forecasts of dispersed dust from excavation, backfilling and ground leveling

No.	Item	Volume of excavating and backfilling		Construction stage (Quarter)	Dust load (kg/day)
		m3	Ton		
1	WWTP	94,107	131,750	12	7.54
2	Collection sewer line	150,163	210,228	6	24.06
3	Stormwater PS	31,800	44,520	10	3.06
4	Wastewater PS				
	PS1	462	647	1	0.44
	PS2	439	615	1	0.42
	PS3	497	696	1	0.48
	PS4	471	660	1	0.45
	PS5	11,311	15,835	1	10.88
5	Balancing lake	22,584	31,618	6	3.62

Note: Unit weight of soil: 1.4 tons/m^3

Thus, the load of dispersed dust from excavation and backfilling in the subproject items varies between 0.44– 24 kg/day.

- Dust and exhaust gases from transportation: According to the standards established by 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-ton diesel vehicles will generate loads of dust and exhausted CO, SO_2, NO_2, and HC as follows: dust: at 1.6 g/km/vehicle; CO gas: 3.7 g/km/vehicle; SO_2:7.43S g/km/vehicle; and HC: 3 g/km/vehicle (diesel of 3% S). The subproject will use 15-ton trucks for transporting. The total passages of trucks and the generated dust loads in the process of soil transportation are calculated as follows (Table 3-5):

Table 3-5. Number of truck passages in constructing items of Component 1

No.	Item	Volume of excavating and backfilling (Ton)	Construction stage (Quarter)	Truck passage (vehicle/day)
1	WWTP	135,973	12	9.7
2	Collecting sewer line	220,715	6	31.4
3	Storm water PS	46,766	6	4.0
4	Wastewater PS			0.0
	PS1	672	1	0.57
	PS2	639	1	0.55
	PS3	723	1	0.62
	PS4	686	1	0.59
	PS5	16,156	1	13.81
5	Balancing lake	31,976	6	4.6
	Total	454,304	39	66

Table 3-6. Generated exhaust loads in constructing items of Component 1

No.	Item	Dust load (mg/ms)	CO loads (mg/ms)	SO2 loads (mg/ms)	HC loads (mg/ms)
1	WWTP	3.6	8.3	4.2	6.7
2	Collecting sewer line	11.6	26.9	13.5	21.8
3	Storm water PS	1.5	3.4	1.7	2.8

No.	Item	Dust load (mg/ms)	CO loads (mg/ms)	SO2 loads (mg/ms)	HC loads (mg/ms)
	Wastewater PS				
4	PS1	0.2	0.5	0.2	0.4
5	PS2	0.2	0.5	0.2	0.4
6	PS3	0.2	0.5	0.3	0.4
7	PS4	0.2	0.5	0.3	0.4
8	PS5	5.1	11.8	5.9	9.6
9	Balancing lake	1.7	3.9	2.0	3.2

From the above pollution loads from dust and exhaust gases, by applying Sutton model with a wind speed of 4.4 m/s and south-western prevailing wind direction in the rainy season, a wind speed 3.25 m/s and south-eastern prevailing wind direction in the dry season, and a distance of 40-80m from generating sources, the concentration of pollutants created by transportation operations can be calculated as follows:

For the WWTP: Dust concentrations vary between 0.1-0.35mg/m^3 (compared with permissible standard limits of 0.3mg/m^3); CO contents between 0.23-0.82mg/m^3 (compared with 30mg/m^3); SO_2 contents between 0.12-0.25mg/m^3 (compared with 0.35 mg/m^3); and HC contents between 0.19-0.41mg/m^3(compared with 5 mg/m^3).

For the collection sewer line: Dust concentrations vary between 0.24-0.54mg/m^3; CO contents between 0.56-1.24 mg/m^3; SO_2 contents between 0.28-0.62mg/m^3; and HC contents between 0.46-0.62mg/m^3.

For the stormwater pumping station: Dust concentrations vary between 0.042-0.092mg/m^3; CO contents between 0.09-0.21mg/m^3; SO_2 contents between 0.05-0.17mg/m^3; and HC contents between 0.08-0.28mg/m^3.

For pumping stations PS1, PS2, PS3, and PS4: Dust concentrations vary between 0.006-0.02 mg/m^3; CO contents between 0.014-0.05mg/m^3; SO_2 contents between 0.006-0.02mg/m^3; and HC contents between 0.011-0.039 mg/m^3.

For pumping station PS5: Dust concentrations vary between 0.14-0.31 mg/m^3; CO contents between 0.32-1.16 mg/m^3; SO_2 contents between 0.16-0.36 mg/m^3; and HC contents between 0.27-0.95 mg/m^3.

For the balancing lake: Dust concentrations vary between 0.05-0.17 mg/m^3; CO contents between 0.11-0.38 mg/m^3; SO_2 contents between 0.06-0.19 mg/m^3; and HC contents between 0.27-0.95 mg/m^3.

Dust:

In general, the loads of dust generated in the process of transporting excavated earth are forecast as being not substantial and would be distributed evenly along transportation routes, between 0.006 and 0.54mg/m^3. According to calculations, the dust concentration would not exceed the national standards on ambient air quality (QCVN 05: 2013/BTNMT) outside 60m of distance. However, it must be noted that the amount of dust generated is large 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 main transport routes for materials transportation would be April 2Street, Nguyen Khuyen Street, Ha Ra bridge area, Xom Bong bridge, Tran Phu Street, Nguyen Xien Street, Pham Van Dong Street, Duong Hien Quyen Street and some other internal transport routes to the South of the city. These are also main transport routes through the city. 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. However, this impact is temporary and can be mitigated. 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, especially along April 2 Street, Bau market area, and the Po Nagar Cham Towers, which are often crowded with tourists and business activities. According to the analysis results of dust contents at the area for construction of the WWTP obtained in February 2016, the dust in the air almost reached the permitted limit of 0.253 mg/m^3 against 0.3 mg/m^3 – QCVN 05:2013/BTNMT, generated by a number of vehicles traveling through the area. Thus, at some points of time, construction at the WWTP site may cause dust contents to high and exceeded the permitted limits.The subproject will have to apply necessary mitigation measures to maintain the air quality in the area up to applicable standards.

In general, the subproject would exert impacts from dust on the residents and businesses, with dust concentrations likely to exceed the permitted limit when construction would be at its peak. 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 ground leveling, excavation, backfilling and transportation is thereby assessed as being medium.

Exhaust gases:

The CO contents in the areas are between 0.014-1.24 mg/m^3.The SO_2 contents are between 0.05-0.6 mg/m^3; and HC contents between 0.011-0.62mg/m^3. Outside 40m of distance, the results of analysis of exhaust gases compared to the national ambient air quality standards (QCVN 05: 2013/BTNMT) shows that they are still within the permissible limits. According to the survey, households along the routes of waste transport and disposal, mainly along April 2Street, Nguyen Khuyen Street, Tran Phu Street, and Hung Loc Hau Street towards the subproject area, would be affected by dust or exhaust gases. So would the visitors to the Po Nagar Cham Towers. This impact level is assessed as medium.

b. Noise

Noise is normally generated from operating construction machineries and equipment (excavators, trucks, concrete mixers...). The level of noise can be forecasted as follows:

Noise transmittance and dispersion can be calculated with the following formula:

$L_{eq} = E.L + 10\log(U.E) – 20 \log(D/D_1) – 10\ G \log(D/D1)$

In which:

- L_{eq}: Noise at distance D
- E.L: Noise at measurement position (distance D1 m from generating source)
- G: Topographic coefficient
- D: Distance to be calculated
- D1: Distance measured from generating source
- U.F: Efficiency factor of machine

As most machines are maximally utilized, thus U.F = 1, and in this case, with no obstacles assumed, then G = 0. Thereby, the noise transmittance can be calculated with:

$L_{eq} = E.L – 20 \log (D/D_1)$

The levels of noise pollution from construction and transport means are presented below (Table 3-7):

Table 3-7.Levels of Noise Pollution

No.	Name of machines, equipment	Noise at 15.24 m*	Noise transmittance (dB)					
			50 m	80 m	100 m	120 m	150 m	200 m
1	Bulldozer	85	74.68	70.60	68.66	67.08	65.14	62.64
2	Excavator	83	72.68	68.59	66.66	65.08	63.14	60.64
3	Roller	74	63.68	59.59	57.66	56.08	54.14	51.64
4	Truck	88	77.68	73.60	71.65	70.08	68.14	65.64
5	Cutting machine	93	82.68	78.60	76.66	75.08	73.14	70.64
QCVN 26–2010/BTNMT								
6h – 21h		*70*	*70*	*70*	*70*	*70*	*70*	*70*
21h – 6h		*55*	*55*	*55*	*55*	*55*	*55*	*55*

*Source: * The US Federal Transit Administration (FTA). Transit Noise and Vibration Impact Assessment. 2006*

Noise would impact directly construction workers on site and residents near or along the construction route. According to calculations, within 15 meters, noise intensity is evenly over 85dB. As this is the noise threshold, if humans are continuously exposed to such intensity, they will suffer from fatigue and unpleasant feelings. If noise exceeds 90dB, it will adversely affect hearing. Except for the residents along April 2 Street and Bau market area, other receptors are located farther than 20m from the construction sites. Such areas as the sites for the construction of the balancing lake, pumping station PS5, and the stormwater pumping station are all within 100-200m from the residential areas. From these distances, noise generated by various types of machines would smaller than 70 dB (QCVN 26-2010/BTNMT from periods of time from 06:00 am to 21:00). Impacts from noise can thus be assessed to be negligible. However, noise generated by night-time construction (21:00-06:00 am) can still exceed permitted limits. Therefore, mitigation measures would be needed for the workers on the construction site to avoid long exposure to loud noise and to reduce the noise level. The impact level of noise is assessed as being medium.

The areas that may be affected by noise, dust, and exhaust gases, are listed in Table 3-8.

Table 3-8. Special subjects affected by noise, dust and exhaust gases

No	Affected subjects	Construction items	Distance to construction sites
1	Residents along April 2Street	Construction of drainage sewers, dimension from 1x1 to 2.5x1.5 (m) Pressure pipeline (D200) for wastewater collection	Close to construction route
2	Bau market area (close to April 2 Street)	Construction of stormwater drainage sewers (D600, D1000) in Bau market area, dimension from 1x1 to 2.5x1.5 (m) on April 2 Street	Close to construction route
3	The Po Nagar Cham Towers	Close to construction sites for road, northern embankment of Cai river, sewers in April 2 Street, Chu Dong TuStreet	30m
4	Tran Phu Street, section from Tran Phu bridge to intersection with Tran Kim Hung Street	Construction of interceptor sewers (D300), CSOs: CS04, CS05, CS06	20m

5	Residents along Ngoc Hiep commune road (Ngoc Hiep ward, Van Thang ward)	Close to construction sites for road, Southern embankment of Cai river	50m
6	Areas on Dien Bien Phu, Duong Hien Quyen, Mai Xuan Thuong, and Pham Van Dong streets (Duong De, Vinh Hoa residential areas)	Areas for constructing wastewater collecting sewers (D200, D400, D300)	Close to the construction site
7	Residents along Phu Xuong area	Near construction site for CSO: CS01, wastewater sewer D800	100m
8	Residents along Hung Loc Hau Street to the WWTP with less impacts as the area is rather sparsely populated	Construction of WWTP, sewer line (D700) conveying wastewater to WWTP	Close to the construction site
9	Residents along Nguyen Khuyen Street	Near construction site of Road No. 4, balancing lake (200m from road)	200m
10	Residents in the north of the city	Construction of tertiary pipelines for wastewater collection	Close to the construction sites
11	Ba Lang Parish	Construction of sewers(D200, D400, D300), pumping station PS1	at a distance of about 30-50m
12	Market at Duong Hien Quyen-Dien Bien Phu intersection	Construction of sewers(D200, D400, D300), pumping station PS1	Close to construction route
13	Vinh Hoa 2 Primary School	Sewers(D300) School sanitation block	30m
14	Vinh Hoa 1 Primary School	Sewer (D400) School sanitation block	40m
15	Vinh Tho Primary School	School sanitation block	Close to construction site
16	Vinh Hoa 2 Primary School	School sanitation block	Close to construction site
17	Vinh Ngoc Primary School	Construction of WWTP, wastewater conveying pipeline (D700) to WWTP	50m

If construction work is carried out at night in these areas, the noise levels all exceed permitted limits within a radius of 200m. During the daytime, these areas will be affected by noise within a radius of 50m. Especially, due to the construction of the school sanitation blocks, the pupils of Vinh Hoa 2, Vinh Hoa 1, Vinh Tho, and Vinh Hai schools, would be affected by noise. Therefore, the contractors would have to carry out mitigation measures to reduce the impacts of noise on learning activities at these schools. The impact level of noise is assessed to be medium.

c. Impacts from vibration

The construction process with the use of means and equipment can give rise to vibration in the earth foundation. Such vibration is transmitted along the earth environment but is strongly reduced in proportion with distance.

The levels of vibration generated by a number of construction equipment are given in Table 3-9 and Table 3-10.

Table 3-9. Levels of vibration caused by typical construction equipment

No.	Machine/Equipment	PPV at 7.62 m (mm/s)	Corresponding Lv at 7.62 m (VdB)
1	Compression-type piling driver		
	+ High level	**0.463**	112
	+ Normal level	**0.196**	104
2	Rammer	0.064	**94**
3	Pile driving hammer	0.027	**87**
4	Big bulldozer	0.027	**87**
5	Driller	0.027	**87**
6	Heavy truck	0.023	**86**
7	Drilling hammer	0.011	**79**
8	Small bulldozer	0.001	**58**

Source:D.J. Martin. 1980, J.F. Wiss.1974, J.F. Wiss. 1967, David A. Towers. 1995.

Table 3-10. Assessment of impact level caused by vibration

No.	Type of work	PPV (mm/s)	Approximate Lv (VdB)
1	Reinforced concrete, steel, wood (without plastic)	0.153	102
2	Technical concrete, normal mason works (without plastic)	0.092	94
3	Unprocessed wood and major mason works	0.061	98
4	Housing oversensitive to vibration	0.037	90

Source: Swiss Consultants for Road Construction Association, "Effects of Vibration on Construction," VSS-SN640-312a, Zurich, Switzerland, April 1992.

UnderComponent 1, construction means to be used would include pile drivers, rammers, bulldozers, and heavy trucks. Based on the results presented in Tables 3-9 and 3-10, the safe distance for bearing strong impacts from vibration is about 10 meters from the generating source. The area affected the most would be that of houses near the construction site of drainage sewers. Meanwhile, the areas for the WWTP, balancing lake, stormwater pumping stations, and wastewater pumping stations are agricultural areas. The impact level of vibration is assessed to be low.

d. Odor

Component 1 consists of the use of odor-preventing manholes and the construction of some drainage sewer lines from the existing downgraded sewer system in such areas as April 2Street, Bau market, and Nguyen Khuyen Street. This process can generate stinking odor from the mud accumulated at the bottom which contains many complex organic compounds in anaerobic conditions and releases odorous compounds such as mercaptans and organic acids, phenols, p-cresol with very unpleasant odors. However, there would be no safety risk of asphyxia from toxic gases for workers as the sewer lines would not be deeply installed and would be open during construction. Therefore, the workers would not have to carry out their work within closed spaces. It can thus be seen that improper handling of the sludge dredged from existing sewers during construction would cause inconveniences, affecting the people's living. The impact level of odors is assessed to be medium.

A.3.2.2.2. Water Pollution

Construction processes are bound to generate wastewater and stormwater runoff from construction sites and material storage yards at workers' camp. Poor management of wastewater could cause pollution of water sources in the area, threatening the environment and spreading diseases sources from the polluted water environment.

a. Wastewater

It would be expected that about200 workers would be mobilized for construction of the sewers, 80 workers for construction of the WWTP, 10 workers for each pumping station, and 40 other workers for construction of the balancing lake. Therefore, at a peak time, a total of 390 workers would be working if all the construction items would be executed at the same time. According to Vietnam Construction Standard TCXDVN 33:2006, the water use norm is 165 Liter/person.day. The contractor will prioritize hiring local workers to reduce the numer of workers staying on site as well as to reduce volume of domestic wastewater generating from workers' activities. The volume of wastewater is calculated at 90% of the amount of water consumption. Based on the mentioned number of workers and aforesaid wastewater generation coefficient, the volumes and loads of domestic wastewater can be forecasted as presented below (Table 3-11):

Table 3-11. Generated domestic wastewater

No.	Item	Number of workers (person)	Wastewater volume generated (m^3/day)
1	WWTP	80	3.96
2	Collecting sewer line	200	9.90
3	Stormwater PS	20	0.99
4	Wastewater PS		
	PS1	10	0.50
	PS2	10	0.50
	PS3	10	0.50
	PS4	10	0.50
	PS5	10	0.50
5	Balancing lake	40	1.98
Total		390	19.3

Wastewater from domestic activities would contain many suspended solids, organic matters, nutrients and microorganisms. The loads of pollutants in wastewater without collection and treatment systems are presented in Table 3-12 below.

Table 3-12. Loads of pollutants in domestic wastewater

No	Pollutants	Load (kg/day)
1	BOD_5	0.45-0.54
2	COD	0.702-1.02
3	TSS	0.7-1.45
4	T-N	0.06-0.12
5	T-P	0.008-0.04
6	Cl^-	0.04-0.08
7	E. coli	10^5-10^6

(Source: WHO, 1993)

Thus, the total volume of domestic wastewater generated from construction processes will be about19.3 m^3/day. Without proper management, domestic wastewater will deteriorate the landscape, pollute land, water, and air environment, and create favorable conditions for

pathogens to proliferate. These, in turn, will adversely affect the health of communities and workers. With the construction time for the WWTP and balancing lake of 12 and 6 quarters, the total volume of wastewater generated will be 277m^3 and 1069 m^3 respectively. This is small amount of wastewater, which presents high risks of pollution from microorganisms, BOD5, and ammonium. Pollution poses a greater threat if wastewater is discharged directly into the creek near the WWTP. Contractors are to work out measures to manage this volume of wastewater.

It is assessed that, for the construction of each work item, there will be a fairly small amount of generated domestic wastewater. Therefore, the impact level of wastewater is assessed to be low

b. Stormwater runoff

Stormwater running through the construction sites will increase turbidity and the content of suspended solids, adversely affecting water quality and aquatic life, possibly contributing to the increase of the sedimentation level of the water-course as it brings along soil, waste, oil, etc. from the construction sites into existing drainage channels, rivers and sea catchments, or causes flooding in the area. Without proper management, runoff flowing through the worker camps could also take along domestic waste and human wastes, triggering pollution and diseases.

An assessment of the impact of stormwater runoff over the construction area on the surrounding environment can be based on the method of calculating the drainage of a hydraulic system with the following formula for intensity limits (Source: Environmental Engineering Handbook, 2005) as follows:

$$Q = C * I * A/1000$$

In which:

Q: volume of stormwater runoff (m^3/day);

C: Flow coefficient; with C = 0.6;

I: Precipitation value (mm/day). According to data on rainfall presented in Chapter 2, the precipitation in Nha Trang greatly varies through the months, with a maximum of 277.6mm in 2014 , averaging about 0.01m/day;

A: Catchment area (m^2).

Hence, the amount of stormwater runoff on the construction site can be estimated as follows:

- ***Construction of collecting system***

The wastewater collection and drainage system is of a total length of 15,385 m. The construction of the system would follow the successive construction method, with about of 200m of sewer each time. It is estimated that about 2m of the pavement width must be occupied for the construction of the wastewater collection and drainage system. Hence, the construction area for each period will be about 400 m^2. The daily amount of stormwater runoff can be estimated as follows:

$$Q_1 = 0.60 * 0.01m/day * 400\ m^2 = 2.4\ m^3/day.$$

Experiences from the CCESP have shown that drainage was not good in some areas (e.g. Hung Vuong Street, Quan Tran area, etc.) which could be flooded in heavy rains, impeding traffic and travelling, threatening environmental sanitation, and affecting the construction process.

Bau market area is to receive proper attention, as this is a low land prone to flooding during construction. The impact level is assessed asmedium.

- ***Construction of the WWTP***

The WWTP will be built in an area of 3 hectares, and the amount of stormwater runoff during the day can thus be estimated as follows:

$$Q_2 = 0.60 * 0.01m/day * 30.000\ m^2 = 180\ m^3/day.$$

The WWTP area currently has a base level of -0.8 to +5m and needs to be leveled to +3.8m. Then the runoff flow will affect drainage and flooding in the areas which are lower than the designed elevation of the WWTP of designed elevation after leveling. If the drainage capacity is poor, it will cause flooding and pollution as stormwater would become stagnant. This body of stagnant water will provide ideal places for mosquitoes and pathogens to gather and proliferate.

The impact level is assessed to be medium.

- ***Construction of the balancing lake***

The area for the construction of the balancing lake is 1.05 hectares, and the amount of stormwater runoff during the day can be estimated as follows:

$$Q_2 = 0.60 * 0.01m/day * 10500\ m^2 = 63\ m^3/day.$$

The excavation of the lakebed may cause stormwater to stagnate. Without effective management, waste in the construction site will be stagnating together with stormwater at the lake bottom, giving rise to mosquitoes and living pathogenic organisms. The impact level is assessed to be medium.

According to measurements made in 2009 by the Ho Chi Minh City Institute of Hygiene and Epidemiology, the concentration of pollutants in stormwater in urban areas with no contamination sources and with construction works is as follows (Table 3-13):

Table 3-13. Concentration of pollutants in stormwater runoff

Pollutant	Stormwater 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 stormwater 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 permissible discharge limit. The impact level is assessed to be medium.

A.3.2.2.3. Solid Waste

a. Excavated soil during construction

Earthwork (excavation, backfilling, and dredging) will be carried out during construction of the collection sewers, stormwater pumping stations, wastewater treatment plants, and balancing lake. This activities would generate a volume of wastesindicated in Table 3-14

Table 3-14. Volume of excavation and backfilling materials

Item	Collecting sewer	Storm water	PS1	PS2	PS3	PS4	PS5	WWTP	Balancing lake	Total
Volume of excavation(m^3)	102,679	14,837	461	439	497	471	3,275	25,252	12,890	299,711
Volume of backfilling (m^3)	47,484	16,963	0	0	0	0	8,036	68,875	9,695	151,053

Thus, the total volume of excavated soil during construction is 299,711m^3 (approximately 41,9595 tons), with a volume of vegetation to be cleared being about 2.6 tons on a total area of approximately 26,553 m^2 of agricultural land to be cleared (generation coefficient of vegetation biomass estimated at 0.1 ton/ha). The volume of backfill is about 152,053 m^3. The balance between excavation and backfilling is thus 148,658 m^3

The analysis of the soil quality in the area shows that the soils meet the national standards for heavy metal concentrations in soil (QCVN 03: 2015/BTNMT). However, there are some areas where the soil has been salinized, specifically in the area of the WWTP with a total extra amount of about 25,252 m^3. Without proper management, the amount of salinized soil can exert negative impacts on the soil environment and crops. Therefore, this amount of excavated soil needs to be partially transported and temporarily gathered in the construction site.

This volume of unused soil will be transported and used for ground leveling in the site planned for the Administrative and Urban Center of Khanh Hoa province. This disposal site was approved by the province, which is an optimal option in the context of limited vacant land availablein the area. The salinity of groundwater in this area is 2.6‰, and that of the soil is 2.7‰, which is similar to the salinity of the soil in the area of the WWTP. This would, therefore, limit salinity impacts on the surrounding environment.

As the area of the WWTP shows signs of salinity contamination which may affect construction works, appropriate construction materials should be appropriately selected.

As for normal excavated soil, the subproject will coordinate with other agencies to use this excavated soil for ground leveling. Otherwise, this excavated soil must be disposed of in Luong Hoa Landfill. If this volume of excavated soil is gathered on site, heavy rains can sweep it away, thus increasing the turbidity of stormwater runoff and heightened the risk of sedimentation in the drainage conduit. These excavated materials can be temporarily stored in a landfill cell for later use as covering materials by leveling it out after each day.

The volume of the excavated soil to be disposed of only about 148,65m^3. However, as 25,252m^3 of this is medium salinized soil,the impact level of excavated soil during construction is assessed to be medium and requires strict management measures.

b. Domestic waste

Since many workers would be recruited locally or they would lend houses of the local residents, the number of workers at the camps on the construction site would be about 120 if all the packages are carried out at the same time.Each worker would generate about 0.5 kg of domestic waste/day, i.e. 60 kg/day. For the WWTP and the balancing lake with respective construction

durations of 12 and 6 quarters, the total amount of the generated domestic wastes would be 11.2 tons and 2.8 tons, respectively. Without proper management, such amounts of generated domestic waste would become a pollutant source, giving rise to bad smells and pathogenic factors from microorganisms.Services of waste collection have been provided in the city, and Luong Hoa Landfill has been put into operation, so the impacts of domestic waste generated during the construction process can be controlled with low risk of pollution.The impact level is assessed to be low.

c. Construction wastes

In Component 1, solid waste will be generated from the demolition of the Community House of Xuan Ngoc hamlet, the fence walls of Vinh Ngoc Primary School, and 12 residential houses. The demolition volume is estimated at about 403 tons. The impact level from debris is assessed as small.

Construction wasteswould include used construction materials such as cement bags, residual iron and steel scraps, wood chips, empty cartons and boxes, etc. The total amount of construction wastes generated during construction will be 4,065 m^3. Without proper collection and recycling, these would have negative on the environment and be wasteful. This type of waste is composed of inert and non-toxic substances, some of which can be recycled or re-used for other purposes. The impact level is assessed to be low.

- ***Construction site of the WWTP***

It is estimated that the amount of generated waste is approximately 0.1m^3 of waste/1m^2 ofconstruction area[8], which is 30,000 m^2 for the construction of the WWTP. With a construction duration of about 3 years, the amount of generated waste would be: 0.1 x 30,000/(3*365) = 2.7 m^3/day. In 3 years, the total amount of construction waste would be 2,956.5 m^3. This amount of waste can be collected and sold to scrap trading units (residual iron and steel products...), or re-used for recycling (cement bags, wood chips, empty boxes and cartons...) to limit disposal needs. The impact level is assessed to be low.

- ***Construction site of thebalancing lake***

With the construction stage lasting about 1.5years, the amount of generated construction waste will be: 0.1 x 10500/(1.5*365) = 1.9 m^3/day. The total amount of waste generated during the construction stage would therefore be 1,022 m^3. This amount of waste can be collected and sold to for scrap trading units (residual iron and steel products...), or re-used for recycling (cement bags, wood chips, empty boxes and cartons...) to limit disposal needs. The impact level is assessed to be low.

- ***Construction site area for collection sewers and drainage lines***

According to the norms of estimates forcivil works – installation (issued together with Decision No. 587/QD-BXD dated 29/5/2014), the wastage norms of construction is 0.5% of 100m of the lengths of pipes and box culverts. With an amount of construction materials for sewer collection system of 17,327 m^3, the amount of construction wastes generated would be: 0.5% x 17,327 = 87m^3, which is not a large amount. The impact level is therefore assessed to be low.

A.3.2.2.4. Hazardous Waste

Hazardous wastes generated from subproject implementation would include waste grease and oil, oily rags, and empty oil/grease containers. The existence of grease from maintenance and

[8]*Reduction of Construction Waste Final Report (March 1993). Hong Kong Polytechnics.*

repair of transportation and construction means in the subproject areas is inevitable. The amount of waste grease and oil generated during construction depends on the following factors:

- The amount of transportation and construction means in the construction site;

- The amount of oil discharged from transportation and construction means;

- Scheduled changes of oil and maintenance of machinery and equipment.

The average amount of grease and oil discharged from machinery and equipment is 7 liters/each change. Oil change and maintenance of machines-equipment are scheduled every 3 months at most. The number of vehicles and construction means needing oil changes is 49 (including 14 trucks and 35 construction means). The amount of waste grease and oil generated in the construction site therefore averages (49 x 7 liters/time)/3 months = 114 liters of oil/month. In addition, the subprojectwould also generate an estimated amount of 50 kg of oily rags and containers per month.

Without appropriate management, these types of construction waste would have negative impacts on the soil, water, and air environment; residual grease and oil in containers can penetrate into the ground, causing soil pollution.The impact level is assessed to be medium.

A.3.2.2.5 Impacts on Aquatic Species and Terrestrial Ecology

Impacts on aquatic species: The only water body in the construction area for the items of Component 1 is a small ditch in the site for the construction of the WWTP. This ditch has been much impacted by human activities, receiving a part of daily domestic wastewater.According to surveys on the current status, there have been no records on living creatures to be conserved or migrating fishes in this ditch. Therefore, the impact level on fish species is assessed to be low.

Impacts on terrestrial ecology:

The subproject area is covered with only wild plants such as grass, water lettuce, nipa palms, etc. in the area of building the balancing lake andthe WWTP, and a number of popular animals such rats, frogs. The area is with low biodiversity value, so the impacts on terrestrial ecology is almost negligible. The impact level is assessed to be low.

The construction of the drainage system is carried out mainly on urban land with main drainage pipes will be laid mostly in the curbs, sidewalks, and therefore will exert no impact on the ecosystem.

A.3.2.2.6. Impacts on Urban Beauty and Landscapes

As mentioned, construction activities would require excavation on some roads and road sidesfor the construction of the tertiary sewer, stormwater, and wastewater drainage systemsand setting up of wall fences for the construction sites. These operations would temporarily change the landscapes and affect urban beauty. Besides, construction materials would also be transported and gathered at construction sites. Without proper management, indiscriminate gathering of materials would take place, especially in narrow construction sites for the tertiary culverts, stormwater, and wastewater drainage systems, affecting the city's landscape.

Pumping stations PS1, PS2, PS3, and PS4 would be constructed at vacant land lots in urban areas, and construction would have certain impacts on the city's landscape from the gathering of materials and machines.

Sensitive areas requiring attention during the temporary gathering of construction materials which may adversely affect general nice views, especially for a tourist city like Nha Trang, include: the Po NagarCham Towers (near the construction of stormwater and wastewater

drainage sewers on April 2 street), An Ton Church area (close to the construction site of stormwater drainage and wastewater sewers on April 2 street), and Ba Lang Parish area (near the construction site of pumping station PS1 and wastewater collection sewer lines).

Construction of the WWTP, PS5 pumping station, and the balancinglake wouldchangethe landscape and vacant land with wild plants. The surface organic soil layer will be excavated and removed. However, as these areas are located far from urban areas and the existing landscapes do not reflect any aesthetic value, this impact is therefore negligible. The design of the plant and the balancing lake will take into consideration landscaping design of the planting of green trees so as to ensure the future landscape and beauty in these areas, and to limit heat collection and generation from concrete works.

The construction of school sanitation blockwould 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 school campus. The design of the school sanitation blocks (with the shape of a ladybug) already used under the CCESP provides a good referential example (Figure 3-1).

The level of impact on urban beauty and landscape is assessed to be medium.

Figure 3-1. Ladybug-shaped school toilet

A.3.2.2.7. Impacts on Water Quality

Runoff from the construction area for the WWTP can carry with it oil, grease, and waste down to the creek next to the plant, increasing turbidity, suspended solids, oil and grease. With low dissolution and no settlement, oil and grease can move downstream. Another factor bound to cause water source pollution would be domestic wastes and wastewater from the worker camps, especially in the areas for the WWTP and stormwater pumping stations. This source of pollutants (estimated at 1.4-4.5 m^3/day), withoutgood management, would be discharged directly into rivers and creeks and cause organic pollution (BOD, COD) and nutrient pollution (N, P) to the receiving waters.However, with a small volume of generated wastewater and stormwater run-off (of about 180 m^3/day) concentrated only at some points of time during a number of days in the rainy months, the impact level is assessed to be low.

A.3.2.2.8. On-Site Flooding

At present, the WWTP area, Bau market, Dien Bien Phu street (Figure 3-2), and SOS Children's Villageare low-lying areas with great likeliness of flooding from heavy rains, with inundation lasting up to one hour. If management oflocal drainage would not be sufficient during construction, rains can cause flooding in the site, affecting the local residents and construction works. Heavy rains can also carry with them solid wastes and construction wastes

down into the existing drains, blocking the drainage system and reducing the drainage capacity. Thus, construction units should actively work out measures to prevent on-site flooding during heavy rains.

Figure 3-2. Areas of Bau market and Dien Bien Phu street prone to flood and inundation

Besides, attention should also be paid to potential flooding caused by shallow groundwater (existing at a depth of 0.2-1.5m) during the excavation process of foundation pits and pipe trenches, especially in the areas for the balancing lake and the WWTP. This can hinder or delay the construction process.

The impact level is assessed to be medium.

A.3.2.2.9. Traffic Disturbances, Increased Traffic Risks

Road traffic: It is estimated that, during the construction in the city area, there would be an increase of the number of vehicles transporting raw materials and wastes for disposal at 66times/day onaverage. The increase in traffic flow and the narrowed road surface on some streets would increase the risk of traffic accidents and traffic congestion, especially during peak hours, in densely populated areas and at road intersections. As Nha Trang is a tourist city with lots of visitors flocking in, there would also be risks of possible traffic accidents. In areas relatively distant from residential areas such as those for stormwater pumping stations and the WWTP (Vinh Ngoc commune), the balancinglake, or pumping station PS5 (Vinh Hai ward), there would be less risks of this kind. Nevertheless, such areas as those along April 2 Streetand Pham Van Dong Street, and the construction site of tertiary sewer lines in wards and communes are much exposed to relatively heavy traffic, the risk of traffic accidents would be higher. The impact level is assessed to be medium.

Railway traffic: One segment of the pressuresewer from PS5 to the WWTP would go under the railway. The sewer line under the railway will be constructed by using impact drills and reinforcements of load-bearing beams. This method of construction will help prevent risks of railway accidents for both passengers and construction workers, without affecting railway traffic schedules. However, proper attention must be paid to railway safety during construction. Otherwise there may be potentially high risk of damages to the trains causing human casualties (both for the railway passengers and workers), and temporary interruption of the train schedules. The impact level is assessed to be medium.

Figure 3-3. Location of the sewer segment passing beneaththe railway

Theareas potentially affected by traffic safety during construction are detailed in Table 3-15.

Table 3-15. Main areas affected by traffic safety during construction

	Affected subjects	Work items
1	- April 2 Street - Po Nagar Cham Towers - Bau market - Ha Ra bridge	- Installation of stormwater drainage sewers (D600-D1000) - Installation of wastewater collection pressure pipeline (D200) - Installation of stormwater drainage sewers (D600, D800) - Installation of sewers (D600-D1000) - Construction of roads and embankments on banks of Cai River
2	- Parking lot of Po Nagar Cham Towers	- Construction of pumping station PS2
3	- Pham Van Dong street near Tran Phu bridge to Tran Kim Hung intersection - Parking lot at Northern end of Xom Bong bridge	- Construction of PS2 pumping station, CSOs (CS05 and CS06) and D300 sewers
4	- Market at intersection between Duong Hien Quyen Street and Dien Bien Phu Street	- Construction of wastewater collection sewer (D400)
5	- Hung Loc Hau Street, narrow of about 2-2.5m	- Construction of WWTP and D700 sewer line for wastewater transmission to WWTP
6	- Nguyen Khuyen-railway interchange - Nguyen Xien-railway interchange	- Construction of Road No. 4
7	- The southern area of the city	- Construction of tertiary wastewater collection sewers
8	- Railway	- Construction of pressure sewer from PS5 to WWTP with one section running beneath the railway

A.3.2.2.10. Social Impacts Related To Construction Activities

Impacts on community relations and social structure:

During the construction stageabout 80 workers would work at the WWTP, 20 at the stormwater pumping stations, 10 at wastewater pumping stations, and about 40 at the balancing lake. Concentration of the workers at these sites would give rise to issues related to security, social

evils, diseases and epidemics, as well as other social problems such as prostitution and drug use.

Due to possible complicated circumstances triggered by labor concentration and the specific characteristics of construction operations, those impacts need to be considered and addressed with suitable measures to maximally limit disadvantages so as to ensure the social efficiency of subproject implementation. The impact level is assessed to be medium.

Impacts on local people's income:

Clearance of the site will be performed in the area crowded with restaurants run by local people on the Southern embankment of Cai river, the area with small business establishments on April 2Street(for the construction of stormwater drains and wastewater sewer lines), the area with a number of coffee shops along Pham Van Dong Street (for the construction of D200 and D400 wastewater collection sewers), the southern area and the part of the city center where tertiary sewers are to be constructed. During construction, such operations as excavation of sewer trenches will block the access to the shops, hinder travel and traffic, generate dust and noise affecting the shops and their customers, etc. Over 200 small-scale and retail shops and stores are estimated to exist along the construction route. Therefore, the business units in these areas may suffer from a reduced incomedue to a reduced number of customers because of limited access and dust nuances. However, such impacts are only temporary during construction. During the construction process, the subproject owner will inform the local people of the construction progress and schedule and ensure prompt and neat construction in order to limit such impacts.The impact level is assessed to be medium.

A.3.2.2.11. Health and Safety Risks to Workers and Communities

a) Health and safety risks to the communities

The demolition of existing works in the site can generate the risk of accidents to local people as well as demolition workers. However, in construction areas of the WWT and the balancing lake(Component 1), the risk of accidents to communities is lower as most of these areas are vacant land with few houses and residents.

During the construction stage, with more workers (about 80 at the WWTP, about 20 at the stormwater pumping stations, about 10 at the wastewater pumping stations, and about 40 at the balancing lake) and free migrants participating in construction or other services, the health care stations will face more difficulties in diagnosing and treating diseases and providing healthcare for communities in case of arising diseases and epidemics. Various and operations would generate domestic wastewater and waste, and the growth of services, breeding activities carried out by households, workers and nonresidents coming to join in providing services 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. Increased contraction of HIV/AIDS and other sexually transmitted diseases, especially through prostitution, pose great risks normally related to large-scale construction subprojects.

During construction, there would be about 50.5 trips of the subproject vehicles per day along theApril 2Streetwhich is densely populated. The contractors and construction units will have to pay proper attention to the risks of traffic accidents to people in using mechanized means in the construction process.

Area of the access road to the WWTP (along Hung Loc Hau Street): As the area is rather sparsely populated and has little traffic, the risk of health impacts on the community is seen as low. However, as the construction site of the WWTP is near Vinh Ngoc Primary School,

attention should be paid to the sensitive subject. Construction work may generate exhaust gases, dust and noise, affecting the health of the school children and distract their learning hours. With the generation of 9.4 trips per day, transport vehicles can give rise to accident risks, especially at times before classes start and when the lessons are over.

The streets to be installed with tertiary sewers, stormwater and wastewater sewer lines and pumping stations PS1,2,3,4 are of relatively narrow and with daily heavy traffic. People and pedestrians moving along these streets may be exposed to the risk of accidents due to the gathering of materials, dropped-off waste left unattended on the streets, open ditches and trenches, and big construction vehicles like cranes.

The construction of school sanitation blocks may pose health risks to students and teachers mainly from generated dust. However, as the work is at a small scale, and construction would not last long, this impact is low and controllable.

The impact level is therefore forecasted to be from low to medium.

b) Health and safety risks to theworkers

Getting into frequent contact with machinery, means and equipment, workers would be regularly exposed to noise and dust at the construction site. In addition, there may be other risks from direct contact with cement and some other hazardous substances such as paints, oils and fuel, which are likely to cause skin corrosion or additives which may penetrate into the body through the skin. Those who work in sewer pits of over3m in depth, on/near the water surface or overhead (on tanks at the WWTP site)would potentially be exposed the risks oflabor accidents if safety measures and protective means notbe available. Also, the storage and/or use of electricity and gases in the camps can give rise to risks of fire and explosion, claiming lives and endangering workers' health.

Social evils also affect workers' health such as HIV/AIDS and other sexually transmitted diseases. Common diseases in the locality as diarrhea, flu, etc. would alsoaffect the workers' health.

In addition, construction operations would raise the risk of work related accidents from such tasks as temporary gathering or dropping off materials and waste, excavating open ditches, etc., especially at night when visibility is much limited, construction materials obstruct the view, and construction means and vehicles come in and out of the construction site.

The impact level is assessed to be from low to medium.

A.3.2.2.12. Impact on Existing Infrastructure

Impact on traffic infrastructure

For the stormwater, wastewater collection sewers, and tertiary sewer network to be constructed, many streets will be excavated or affected by the gathering and transport of materials and construction wastes. The most affected among the streets would beApril 2 Street, Mai Xuan Thuong Street, Duong Hien Quyen Street, Dien Bien Phu Street, Ngo Van So Street, Pham Van Dong Street, and Hung Loc Hau Street. All these April 2 Street and Dien Bien Phu Street are asphalted. An additional amount of about 64 trips/day of 16-ton trucks along these streets will also contribute to the risks of cracks and subsidence of the road surfaces. The construction of the WWTP will use the residents' local roads for transportation. The impact level is assessed to be medium.

Figure 3-4. Residents' local road leading to WWTP area

Impact on water supply and communication infrastructure

At present, the water supply pipelines mainly run along the sidewalks of the streets. Therefore, the construction of sewers under the subprojectmay potentially affect the water supply infrastructure of the area, interrupting water supply operations due to temporary shut-off of water transmission pipelines or to break water transmission pipelines.

The pipeline supplying water to Vinh Ngoc commune also runs across the WWTP area. In case of broken pipeline, the people living in the area will be greatly affected. Therefore,measures to prevent pipe breakage must be devised and carried out during the construction under this subproject.

The impact level is assessed to be medium.

Communication infrastructure: In the construction sites for the WWTP, the balancing lake and the pumping stations, there are no communication infrastructures such as Internet cables or telephone lines. Therefore, there will be no impact on the communication infrastructure in these areas. However, construction of the stormwater and wastewater drainage lines along April 2 Street and Pham Van Dong Street will involve excavation of the roads, and this may rupture the overhead Internet cables and telephone lines, disrupting these services. The impact level is assessed to be from low to medium.

A.3.2.2.13. Impacts on Physical Cultural Resources

There are a number pagodas and churches locatedwithin 30-200m of the construction sites. These physical cultural resources (PCRs) include the Po Nagar Cham Towers, Pho Te pagoda, Thien Hau pagoda, Truc Lam Thien Tu pagoda, An Ton church, and Ba Lang parish. However, it is not anticipated that construction activities wouldexert any major infringements on these physical cultural resources (PCR). Nevertheless, the construction process of different work items would be likely to affect the community religious practices and tourist visitors, including the inconvenientaccess by the communities and tourists; exhaust gases,dust, and noise; and risks of accidents. The PCRs and the site-specific impacts on them during construction are described in details in Table 3-16.

Table 3-16. Listof affected PCRs

	Subproject activity	Sensitive PCRs	Potential impacts
1	- Construction of stormwater drainage and sewer systemson April 2 Street	- Po Nagar Cham Towers (30-100 m from construction site for stormwater and wastewater drainage line on April 2 Street, 150m	- Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and constructionaccidents to tourists and local communities, especially during the festive time from 20th –

	Subproject activity	Sensitive PCRs	Potential impacts
		from PS2, CSO3, and 80m from PS3 of Component 1)	23rd of the third month of the lunar calendar.
2	- Construction of stormwater drainage and sewer systemson April 2 Street	An Ton Church (20m from construction site for stormwater and wastewater drainage sewers on April 2 Street)	- Sensitive time: Saturday evenings, Sunday mornings, Christmas, Easter, All Saints' Day - Impacts: Potential increased dust, exhaust gases, noise, wastes, risk of community safety, and traffic accidents, affecting beauty of the Church area and hindering access to the Church
3	- Construction of D400 wastewater collection pipelines	Ba Lang Parish (30m from construction site for wastewater drainage line on Duong Hien Quyen Street)	- Sensitive time: Saturday evenings, Sunday mornings, Christmas, Easter, All Saints' Day - Impacts: Potential increased dust, exhaust gases, noise, wastes, risk of community safety, and traffic accidents

A.3.2.3. Subproject Operation Phase

A.3.2.3.1. Wastewater Treatment Plant

(i) Impact on the water quality of receiving waters

The collection and treatment of wastewater in the area will help reduce a large amount of pollutants discharged into Cai river. With a capacity of 15,000 m^3/day and the treated effluent watermeeting the Column A (e.g., effluent water meeting the inputs for domestic water supply) of the national standard on industrial waste water (QCVN 40: 2011/BTNMT), the specific amounts of pollutants reduced would be as follows: BOD5: 2.1 tons/day, TSS: 2.1 tons/day, NH_4^+-N: 0.3 tons/day, PO_4^{3-}P: 0.04 tons/day. This will help improve the quality of river water and coastal seawater at the estuary of Cai river.

The concentration of pollutants in Cairiverwhen it receives treated wastewater at the river's lowest level is calculated as follows:

$C = (Q_n * C_n + Q_s * C_s)/(Q_n + Q_s)$

In which:

- C : forecastedcontaminant concentration
- C_n : contaminant concentration after treatment
- C_s : contaminant concentration in Cai River
- Q_n : flow of wastewater source (0.17 m^3/s)
- Q_s : flow of Cai River (min. flow Q_s=5.1 m^3/s)

Table 3-17. Calculations of Cai river water quality when receiving wastewater

No.	Pollution parameters	Cn	Qsmin	Qn	Cs*	C
1	Ammonium	3	5.1	0.17	0.51	0.59
2	BOD_5	10			18	17.7
3	SS	22			41	40.3
4	PO_4^{3-}	4			0.43	0.5

Note: (*) *Data extractedfrom the Environmental Information Report ofKhanh Hoa in 2015 – Khanh Hoa Department of Natural Resources and Environment (maximum level)*

It can be noted that in the driest condition, when receiving treated wastewater, the water quality of Cai river changes as follows: NH_4^+ concentration increasing by 15.6%, BOD_5 concentration decreasing by 1.7%, and PO_4^{3-}increasing by 16.2%. These indicators are still within permissible limits of the national standard of column B2 for water quality for waterway traffic and other purposes. Downstream from the effluent receiving point at Cai river, there is no water use for water supply.

In the current area of the future WWTP there are inadequate tertiary networks for collecting wastewater. Most of the wastewater would penetrate into the ground or be retained at localized places in residential areas and decompose by itself, causing environmental pollution in these residential areas, or discharge itself into ponds, lakes and the river. The existing discharge into the river is of a small scale, distributing along the entire river section flowing through the city. It can be seen that when 15,000m^3 of treated water/day is discharged into Cai river from the northern catchment, there will be a slight increase in the values of water indicators such as ammonia, PO_4^{3-}. However, this increased value is only about 0.08mg/l even at lowest river levels, and the water quality is still within permitted limits. Other indicators such as BOD_5 and SS would tend to decrease, improving river water quality.

Heavy rains pose a risk that may affect the water quality. As the wastewater collection system is a combined one, heavy rains may cause wastewater to overflow out into the environment or may result in larger amounts of wastewater that exceed the treatment capacityof the WWTP. This would likely lead to input overload of WWTP and damages to the equipment. However, this issue has been studied in designing the collection system. Stormwater and wastewater will be collected into M1 ditch, where a constructed CSO will separate and take the stormwater to the balancing lake, and the remaining wastewater will be transmitted to the WWTP. The collection pipelines would be designed to ensure that the treatment capacityof the WWTP would not be exceeded, and the said impact can be eliminated.

(ii) Offensive Odors

Odors from the wastewater treatment process are generated mainly from the treatment units where anaerobic decomposition takes place. Aerobic decomposition also generates offensiveodors but at lower levels.

- Those units which possibly generate badodorsinclude the screener, the anaerobic tank, and oxidation ditch, and the sludge treatment site. It will be easy to install devices to collect and convey the bad odors to the odor treatment site.
- The main gases generated from anaerobic decomposition consist of H_2S, mercaptans, CO2, CH4,ofwhich H2S and mercaptans, the main factors giving rise to mal odors (Table 3-21).

Table 3-18. Odorous compounds generated by anaerobic decomposition of wastewater

Compounds	Formula	Typical odor	Detection threshold (ppm)
Amyl mercaptan	CH_3-$(CH_2)_3$-CH_2-SH	Unpleasant,stinking smell	0.0003
Ethyl mercaptan	CH_3CH_2-SH	Smell of decaying cabbage	0.00019
Hydrogen sulfide	H_2S	Smell of rotten eggs	0.00047
Methyl mercaptan	CH_3SH	Smell of decaying cabbage	0.0011
Propyl mercaptan	CH_3-CH_2-CH_2-SH	Unpleasant smell	0.000075

Sulfur dioxide	SO_2	Pungent smell	0,009
Tert-butyl mercaptan	$(CH_3)_3C$-SH	Unpleasant skunk smell	0.00008

Source: 7th International Conference on Environmental Science and Technology Ermoupolis, Syros Island, Greece – Sep. 2001. Odor emission in a small wastewater treatment plant.

Impact caused by aerosol emissions from wastewater treatment

The WWTPwould generate biological aerosols that can be dispersed into the atmosphere. Aerosolsoften contain many kinds ofE. coli, entericbacteria, and fungiwhich 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 3-19.Content of bacteria dispersed from WWTP

Unit: bacteria/m^3 of air

Position against wind direction	Distance			
	0 m	50 m	100 m	> 500 m
End of wind direction	100-650	50-200	5-10	-
Beginning of wind direction	100-650	10-20	-	-

Source: 7th International Conference on Environmental Science and Technology Ermoupolis, Syros Island, Greece – Sep. 2001. Bio aerosol formation near wastewater treatment facilities

The components of the WWTP are located fairly distantly from the school (about 100m). The residential area is also 100-150m from the plant. In normal operation conditions with a closed treatment technology and a separated buffer zone 30m away in accordance with QCVN 07:2010/BXD standards, offensive odors are not likely to exist.

The predominant windsin the WWTP area areNorth-eastern and South-western wind. Down these directions, the population is quite sparse within a radius of 100m. With thesewind directions, mal odors would have less impact on Vinh Ngoc Primary School which is located to the east of the WWTP. The dispersion of bacteria in aerosolswithin a distance of 50m (Table 3-22)couldalso give rise to the risk of contracting diseases to the community. However, the control of offensive odors and aerosolsgenerated from the WWTP can be effectively performed with odor collection and treatment devices. Experiences from the CCESP in the Southern WWTP have shown that badodors were not perceived in the air within the plant premises and beyond the fence.

In case of malfunctioning of the odor treatment system of the WWTP, bad odors and bacteria may be dispersed by the wind within a radius of 100m, adversely affecting residents' and pupils' health. Offensive odors are also much likely to badly affect the operators' health.

The impact level is assessed to be low to medium.

(iii) Sludge:

Raw wastes, separated from the large-sized coarse and fine screeners, are automatically rakedinto a container and carried off to be treated as normal solid wastes at Luong Hoa Landfill.

Sludge generated from the WWTP will be about 2.3 tons/day (for the WWTP's capacityof 15,000m^3/day). 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 Luong Hoa Landfill.

The volume of sludge generated from the WWTP will be transported once every month to Luong Hoa Landfill along Nguyen Khuyen Street and the April 2 Street section connected to National Highway No. 1A. 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)Floodingand inundation risks

Wastewater, after being treated, is discharged into the existing Southern ditch of the WWTP. The parameters of the existing ditch are as follows:

- Minimum width of ditch: ~4m
- Water level in dry season: ~+0.3m (site survey)
- Water level in rainy or stormy season (recorded at water level at existing ditch of Cai river): 2.65m

Assessment on capacity of receiving treated water:

- Bottom elevation of box culvert for treated wastewater discharge: + 2.50m. Thus, in the most adverse case, treated wastewater can still be discharged into receiving waters.
- Flow rate of treated wastewater: Q=15,000m3/day = 625m3/h = 0.174 m3/s (equivalent to D800mm culverts).

Therefore, with the dimension of the existing ditch of Bmin~4m, Q=0.174m/s will raise the water level in the ditch by about 10cm, and the existing ditch can fully receive the treated water from the WWTP.

In addition, the operation of the stormwater pumping station of the subprojectwill yield a flow rate of 40m^3/s to force water pumping into the river. When the water level of Cai River is higher than +2.65m, drainage can be fulfilled with pumping. Therefore, flooding will not be likely to happen.

The design of the WWTP has also taken into consideration flood frequency and level. The elevation the WWTP area will be raised 3.8m compared with the historically high flood level of Cai river was 3m in order to ensure flood prevention.

The impact level is assessed to be low.

(v) Domestic wastewater

With about 20 staff, the estimated domestic water supply per capita for the workers and operators at the WWTP will be 100L/person/day. The volume of domestic wastewater is estimated as 80% of this amount water supply demand, resulting in about 1.6 m^3/day. In general, this amount of domestic wastewater is modest and located within the WWTP. The impacts are therefore considered to be negligible.

(vi) Hazardous waste

Hazardous waste generated from the operation of the WWTP and pumping stations is composed mostly of chemical packaging materials used in wastewater treatment, waste grease and oil, oily rags (about 100kg/year) from maintenance tasks, and broken fluorescent lamps (about 50kg/year), and Chemical packaging materials (about 20kg/year**)** to be discarded. Such waste is a threat to the soil and water environment if dumped into the surrounding. However, such types of waste can be completely controlled during operation so as to mitigate possible impacts.

Besides, chlorine used in wastewater disinfection is also a hazardous gas with any leakage into the environment. Coming into contact with chlorine without protective gear can claim human lives (Continuous contact with chlorine with a concentration of 250ppm during 30 minutes can cause death to an adult) and cause skin or eye burns. A contact with chlorine eat lower concentration will result in chronic diseases like bronchial illnesses, tooth corrosion, breathing difficulties, cough, etc. Therefore, special care must be taken during operation processes when using and handling chlorine.

The impact level is assessed to be medium.

(vii) Solid Waste

It is anticipated that a total of 20 people will be responsible for managing and operating the WWTP. Each person is estimated to generate 0.5 kg of solid waste/day, or 10 kg/day for the whole staff. The impact level is assessed to be low.

A.3.2.3.2. Impacts fromother Works Items

(i) Mal odors

From the stormwater drainage system and from wastewater of pumping stations

In the operation of the stormwater and wastewater drainage system, and wastewater from the pumping stations, the impacts on the air environment will mainly occur in the area of the wastewater pump stations and manholes. However, the gas amounts generated from these are considered to be negligible, as designinghas taken into consideration appropriate technical measures, such as building submersible pump stations and odor-preventing sewer sluices, and replacing old manholes with odor-preventing ones on Dien Bien Phu Street, Dang Tat Street,Bac Son Street; Cu Chi Street; Pham Van Dong Street, and April 2 Street. This will greatly limit the impacts from malodors and other harmful gases generated by the decomposition of organic substances in wastewater. The impact level is assessed as being low.

Odors from school sanitation blocks

Malodors generated by toilet schools mainly come from NH3,affecting students and teachers at the school. The impact from odors can be controlled with a number of measures integrated into the design and regular cleaning during the operational phase (also applied effectively in the CCESP) such as installation of ventilation systems, sufficient water supply and propagation of hygienic behaviors such as flushing after using the toilet, etc. The impact level is assessed to be low.

(ii) Noise from WWTP, pumping stations (PSs)

Impacts come from noise and vibration during the operation of equipment, machinery, pumps from wastewater pump stations.Noise emission from these operations is estimated as follows:

Pump operation: 88 dBA

Operation of water separator: 85 dBA

Operation of air blower: 88 dBA

As the equipment is designed to be submersible pumps or built in construction items such as tanks and the air blower house, the impact of noise transmittance to the surrounding is negligible. The impact level is regarded as low.

(iii) Impact from solid waste

Sludge:

Sludge is generated from wastewater and stormwater collection sewers. It is anticipated that the amount of sludge from wastewater collection sewers would not be significant and would be collected periodically and disposed of at Luong Hoa Landfill. The impact level is seen as low.

Wastewater at school sanitation blocks: According to Vietnam Standard TCVN 4513:1988, water use norm for school is from 15-20 Liter/person thus, the volume of wastewater generating is about 90% volume of feed water

- Vinh Hai 2 Primary School (Nguyen Khuyen Street): 400 pupils, with half daylearning at school; estimated wastewater amount: 400*20*90%/1000 = 7.2 m^3/day;

- Vinh Hoa 2 Primary School (Ngo Van So Street): 400 pupils; estimated wastewater amount: 400*20*90%/1000 = 7.2 m^3/day;

- Vinh Hoa 1 Primary School (Dien Bien Phu Street): 1,050 pupils; estimated wastewater amount: 1050*20*90%/1000 = 18.9 m^3/day

- Vinh Tho Primary School (Ton That Tung Street): 800 pupils; estimated wastewater amount: 800*20*90%/1000 = 14.4 m^3/day

Pollution loads of domestic wastewater:

Table 3-20. Calculation of pollutant concentrations in wastewater

No	Pollutant	Loads (kg/day)*	Ctxl (mg/l)	Cvh2 (mg/l)	Cvh2 (mg/l)	Cvh1 (mg/l)	Cvt (mg/l)
1	BOD_5	0.45-0.54	281-337	56-67	56-67	22-26	28-34
2	COD	0.702-1.02	439-637	88-127	88-127	33-49	44-64
3	TSS	0.7-1.45	437-906	87-181	87-181	33-69	44-90
4	T-N	0.06-0.12	37-75	7-17	7-17	2.8-5.7	3-8
5	T-P	0.008-0.04	5-25	1-5	1-5	0.4-2	0.5-2.5
6	Cl^-	0.04-0.08	25-50	5-10	5-10	2-4	2.5-5

(Source: WHO, 1993)*

This amount of wastewater will go through septic tanks before being discharged into the combined collection sewer of the city then conveyed to the WWTP. Therefore, possible occurrence of pollution caused by wastewater from these areas can be excluded.

A.3.2.4. Assessmentand Forecastsof Impactsfrom SubprojectRisks and Incidents

A.3.2.4.2. Construction Phase

Risks to public health: The large number of construction employees will require well-planned arrangements and organization; otherwise, their health would be badly affected and diseases/epidemics would break out, threatening the surrounding and local residents.

Risks of short circuiting, fire and explosion: These risks may materialize and incidents take place with power consumption devices in the construction site and in worker camps, especially with the risk of lightning strikes on thunderstorm days and due to workers' negligence in using electrical devices; storage yards of raw materials and fuel (paints, gasoline, diesel oil, fuel oil...) may provide sources of fire and explosion. The impactsareassessed to be medium.

*Risks of natural disasters, hurricanes and floods:*Natural disasters, hurricanes and floods may be inevitable and would cause significant impacts on the environment as well as humans. Each year about 2-3 storms would land onto Nha Trang between October and November, with Vinh Ngoc (construction site of WWTP), and Vinh Phuoc, Ngoc Hiep (embankment construction) being most seriously affected. During implementation, the subprojectwill work out plans for construction works associated with the program on managing and monitoring the environment at each stage in order to minimize the environmental impactsfrom natural disasters, hurricanes and floods.

*Risks of settlement and collapse:*Excavation will be carried out for the construction of drainage lines and wastewater collection sewers along April 2Street with depths from 1.3 to 3.3 m; sewer trenches in Bau market from 1.4-2.17m in depth, in Son Thuy area at approximately 3 m deep, in areas in Dien Bien Phu, Mai Xuan Thuong, Pham Van Dong, and Duong Hien Quyen streets at depths of 1-4m.These are densely populated areas with fences and houses close to the construction area for the sewer line. Foundation excavation for the construction of pumping stations, the WWTP, and excavation operations for the bed of the balancing lake at depths of 2-4m are likely to create slopes posing risks of landslides and slumping. With the geological features of a drift sand base, deep excavation would increasethe risks of land subsidence and landslides are very likely to happen, possibly leading to labor accidents. Landslide risk was also a problem encountered by the CCESP during construction at great depths. Therefore, the subproject is to devise appropriate construction methods to put such risk under control in order to avoid bad impacts on other houses in the area. For example, vertical driving of Larsen sheet piles and additional horizontal installation of steel frames in case of construction at great depthswith a lot of drift sand may be effective measures of subsidence prevention which were effectively applied in the CCSEP. The impact level is assessed to be medium

Possible discovery of historic relics and archeological items:In the process of excavating the areas for the balancinglake and the WWTP, relics and archeological items may be unearthed and discovered. It would be a great loss for the country's culture, archeology and even tourism if these relics and archeological items are lost or damaged.Therefore, the subproject will have to devise a handling process once such relics and archeological items are uncovered during construction to avoid losses and damages of the same. The impact level is assessed to be low.

A.3.2.4.3. Operation Phase

a. 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 canal receiving wastewater beside the plant and into Cai river. As a result the receiving waters would be exposed to high risks of contamination from this source of wastewater. Based on the concentration of pollutants in wastewater of Nha Trang (Table 3-21) and on the WWTP capacity, the amount of pollution loads in Cai River as the receiving waters can be calculated as follows (Table 3-21):

Table 3-21. Concentrations of pollutants in untreated wastewater

Criteria	Unit	Northern Nha Trang area
BOD5	mg/l	150
COD	mg/l	270
TSS	mg/l	160
NH4 - N	mg/l	30
Total N	mg/l	23
Total P	mg/l	7

Table 3-22. Loads of pollutants discharged from the source into Cai River

Criteria	Unit	7,500m^3 Stage	15,000 m^3Stage
BOD5	kg/day	1,125	2,250
COD	kg/day	2,025	4,050
TSS	kg/day	1,200	2,400
NH4 – N	kg/day	225	450
Total N	kg/day	172.5	345
Total P	kg/day	52.5	105

To assess the risk of contamination in Cai river from untreated wastewater in the case of failure of the WWTP and compulsory direct discharge of wastewater into the river, it is necessary to determine the capacity of the receiving wastewater of this riveras guided by Circular No. 02/2009/TT-BTNMT providing regulations on assessment of wastewater receiving waters.

The wastewater receiving capacity of Cai river depends on the quality of current river water and contaminants in the wastewater. Some of the environmental criteria typical to receiving watersand waste generating sources are shown in Table 3-23 below.

Table 3-23. Baseline environmental parametersfor calculation of wastewater receiving capacity

Criteria	Unit	Quality of influent (Ct)	Receiving waters – Cai river (Cs, max)*	Permissible limits	
				QCVN 08:2015 (B2)	Safety factor (Fs)
BOD_5	mg/l	150	18	25	0.4
COD	mg/l	270	28.8	50	0.4
TSS	mg/l	160	41	100	0.4
Total Fe	mg/l	2.3	0.7	2	0.4
NH_4^+	mg/l	23	0.51	0,9	0.4

Note: * *Data extracted from Khanh Hoa Environmental Information Report2015 – Khanh Hoa DONRE (maximum level)*

The capacity of the WWTP is 15,000m^3/day (0.17 m^3/s), consisting of 2 units of 7,500 m^3/day (0.09 m^3/s) each.

Cai river as the receiving waterwith a minimumflow in the dry season of Qs = 5.1 m^3/s (Nha Trang city Statistical Yearbook - 2015)

a) Formula for calculation of maximum pollution loads:

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

L_{td}(kg/day):maximum pollution load of the water source for contaminants under review;

Q_s (m^3/s): minimum instantaneous flow in river section

Q_t (m^3/s): maximum wastewater flow

C_{tc}(mg/l): value of concentration limit of pollutants

86.4: is a dimensional unit conversion coefficient from (m^3/s)*(mg/l) into (kg/day).

Table 3-24. Maximum pollution loads of water source

Parameters	BOD_5	COD	TTSS	Ammonium	Fe
L_{td}(kg/day) – 7,500 m^3	11,210	22,421	44,842	403.6	896.8
L_{td}(kg/day) – 15,000 m^3	11,383	22,766	45,533	409.8	910.7

b) Formula for calculation of loads of existing pollutants in receiving waters:

$$Ln = Qs * Cs * 86.4$$

C_s (mg/l) is the maximum value of the concentration of pollutants in the river water before receiving wastewater.

The pollution loads of existing contaminants in the water source are respectively as follows:

Table 3-25. Calculation of loads of existing pollutants in wastewater

Parameters	BOD_5	COD	TSS	Ammonium	Fe
L_n (kg/day)	7,932	12,690	18,066	225	308.4

c) Formula of calculation of pollution loads from wastewater into water source:

$$L_t = Q_t * C_t * 86.4$$

Q_t (m^3/s):maximum wastewater flow

C_t (mg/l): maximum value of the concentration of pollutants in wastewater

The loads of pollutants from the WWTP introduced intothe water source are respectively as follows:

Table 3-26. Loads of pollutants from waste generating source

Parameters	BOD_5	COD	TSS	Ammonium	Fe
L_t (kg/d)-7500m^3	1,166	2,100	1,244	179	17.9
L_t (kg/d)-15000m^3	2,203	3,966	2,350	338	33.8

d) Formula of calculation of the capacity of receiving pollution loads of water source against contaminants:

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

The capacity of the receiving waters after receiving wastewater is respectively as follows:

Table 3-27. Calculation of the capacity to receive waste source

Parameters	BOD_5	COD	TSS	Ammonium	Fe

Ltn (kg/d)-7500m^3	845	3052	1,0212	-0.16	228.2
Ltn (kg/d)-15000m^3	499	2444	1,0046	-61.3	227.4

Thus, in case of incident taking place for one day, 7,500 m^3 of untreated wastewater (upon failure of one treatment unit) and 15,000m^3 (upon failure of 2 treatment units) are fully discharged into Cai river. Then, in the most unfavorable circumstance, Cai river is still able to receive the waste source for the parameters of BOD5, COD, TSS, Fe, but not capable of receiving ammonium. The receiving capacity of Cai river over the time of the incident is calculated as follows:

Table 3-28. Calculation of receiving capacity of Cai River

Parameter	BOD_5	COD	TSS	Ammonium	Fe
Ltn(kg/d)	845	3,052	10,212	-0.16	228.2
L_t (kg/d)	1,166	2,100	1,244	179	17.9
No. of daysof failure (day)	0.7	1.5	8.2	-	12.7

Based on the data on the amount of pollutants from wastewater into the waste source and the receiving capacity of Cai River, it is possible to calculate the number of days of incident on which Cai river is still capable of receiving the aforesaid pollution parameters, respectively: BOD_5 in 0.7 days, COD in 1.5 days; TSS in 8.2 days, and Fe in 12.7 days.

b. 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.

c. 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.

Tertiary sewers may be threatened by risks of cracking, in which case incidents are more probable to take place, giving rise to badodor from the anaerobic decomposition of pollutants in wastewater.Its smell would then be dispersed, affecting the residents.

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.

d. 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.

e. 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.

f. 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.

B. COMPONENT 2

B.3.2.1. Pre-Construction Phase

B.3.2.1.1. Impacts From Land Acquisition And Site Clearance

Land acquisition:

According to the statistics of assets affected by land acquisition for Component 2, thetotal land area to be permanently acquired for this component will be 114,118m^2, in which: 71,677m^2 of residentialland; 22,085$m^2$of agricultural land; and 20,426m^2 of traffic, irrigation and unused land. The subprojectwould affect14,897m^2 of agricultural land which is annual crop in the area of the Southern road of Cai river, 4,857m^2 of agricultural land at Northern road of Cai river, 764m^2 of agricultural land at Road Chu Dong Tu, 1,567 m^2 of agricultural land at Road no.4 (Vinh Hai). Traffic land in the area: 2,119 m^2 of the Northern and Southern embankment roads of Cai river (Ngoc Hiep, Van Thang and Vinh Phuoc), 1,582m^2 on Chu Dong Tu Street (Vinh Phuoc), and 16,725m^2 on Road No. 4 (Vinh Hai).

There will be in total 372 households and 03 social institutions/agencies including Shipping Yard (on Chu Dong Tu Street), the Center for Social Welfare (Road D4), andKhanh Hoa Electricity Joint-Stock Company (Road D4) affected by the subproject. Among these, 125 households are to be displaced, 32 households to be seriously affected by the acquisition of over 20% of production land area (10% for poor and vulnerable households), and 20 business households, 69 vulnerable households. Shipyard would acquire 989 on total 6,925m^2 of land area(without affecting the existing works) for the construction of Chu Dong Tu road; Social protection center and electricity company would respectively acquire 209 and 147m^2on total 23,176 and 708m^2 of land area (without affecting the existing works) for the construction of Road no.4

Social impacts on displaced households:

Those households to be displaced and resettled are likely to suffer psychological troubles, changes in their social relations, and affected income. It will take some time for them to adapt themselves to the new environment with other services such as health care, markets, schooling, etc., and new social relations due displacement. UnderComponent 2, the number of displaced households is rather high (125). The impact level is therefore assessed as being high.

Part of the land of the three institutions/agencies, the Shipping Yard on Chu Dong Tu Street, the Center for Social Welfare, and Khanh Hoa Electricity JS Company,will be partially acquired for the construction of the roads.

The affected business households are those located along the Southern embankment road of Cai river, currently running many kinds of eateries. Such households will be definitely affected in terms of income and livelihood.

Relocation of graves: There are 2 graves in the subproject area to be displaced upon the construction of Road No. 4 (Group 22 – Vinh Hai ward). To the Vietnamese, grave is the religuous and spiritual matters which should be respected carefully. Household and individual graves are considered PCRs, and the Bank's OP/BP 4.11 applies for this subproject. However, this consultation with the households affected by grave relocation reveals that people are still willing to move the graves to another location to give land for construction if the subproject owner supports sufficiently to ensure the grave relocation. The level of this impact caused by this activity is only small and localized.

Gender-related impacts: Thesubproject implementation will cause considerable impacts on the life of local people, especially in households whose owners are females. The subproject's policy of resettlement assistance and compensation will pay special attention to the households whose owners are females and devise policies to mitigate impacts and reinstateliving conditions for the affected females.

The demand for resettlement under the subproject by construction items is presented in the Table 3-29 below:

Table 3-29. Subproject Resettlement Demand

No.	Component	No. of HHs	No. of people	No. of resettled lots
1	Construction of dike and road on Northern Cai Riverbank	08	12	16
2	Construction of dike and road on Southern Cai Riverbank L=1,986m from Railway Bridge to Ha Ra Bridge	60	240	120
3	Construction of Chu Dong TuStreet, L=365m from the intersection with the planned road along Cai River to Nguyen Cong Tru interchange.	12	48	24
4	Construction of Road No. 4, L=1828m from the intersection with April 2 Street to Nguyen Xien intersection.	45	180	90
	Total			**250**

The resettlement demand is identified on the basis of the survey and consultation results obtained in February 2016 for displaced households. Thereby, although up to 125households are to be displaced owing to land acquisition, resettled lotsare expectedto total 250 in case of future household splitswithin families.

The statistics of land acquisition of each subprojectcomponent are as follows (Table 3-30):

Table 3-30. Statistics of impacts from land acquisition

No	Item	Northern road and embankment of Cai river	Southern road and embankment of Cai river	Chu Dong Tu road	Road no.4	Total
1	**Total affected area**	7,883	60,088	9.809	36,408	114,188
1.1	Livelihood land	2,175	43,922	7,463	18,117	71,677
1.2	Agricultural land	4,857	14,897	764	1,567	22,085
1.3	Traffic land	850.5	1,269	1,582	16,725	20,426
2	**Affected works (m2)**					
2.1	Houses	4,550	23,140	3,508	18,976	50,174
2.2	Grave	0	0	0	2	2
2.3	Other	455	2,314	351	1,898	5,017
3	**Affected crop (tree)**					
3.1	Annual crop	0	400	0	0	400
3.2	Perennial crop	400	7,952	400	804	9,556
4	**Total affected house (household)**	25	180	34	133	372
4.1	Displaced households	8	60	12	45	125
4.2	Affected business household	0	15	0	5	20
4.3	Severely household	0	30	0	2	32
4.4	Vulnerable household	2	41	2	24	69

B.3.2.1.2. Safety Risks Related To UXOs

The construction sites located in Nha Trang city have been much affected by human activities, and UXOs detection and destruction have already been performed in the past. According to the experience in the implementation of the CCESP in Nha Trang city, no UXOs have been detected. However, this is a risk to be considered as this kind of hazard, once taking place, may cost much in human lives and properties. Current construction areas of the subprojectsuch as the embankments and roads on the northern and southern banks of Cai river, Road No.4, and Chu Dong Tu Street may face possible risks of UXOs. Therefore, detection and destruction tasks must be carried out before construction can be started.

B.3.2.2. Impacts During Construction Phase

B.3.2.2.1. Air Pollution

Air pollution from dust, exhaust gases, and noise mainly results from such operations as demolition of works, ground leveling, excavation and backfilling, and transportation.

a) Dust and exhaust gases

Air pollution caused by demolition:

The demolition of houses (about 125 houses of the households to be relocated and other temporary works such as walls and toilets) along the southern and northern banks of Cai river, Chu Dong Tu Street, and Road No. 4 can generate dust, affecting the households close to the area. The Southern embankment road of Cai river is 1,986m long, with 25,454m^2 of affected buildings and 60 displaced households. The Northern embankment road of Cai river is 402m long, with 5,005m^2 of affected buildings and 8 displaced households; The Chu Dong Tu Street is 321m long, with 3,859m^{2}of affected buildings and 12 displaced households; The Road No. 4 is 1,828m, with 20,874m^2 of affected buildings and 45 displaced households.

On the Southern bank of Cai river, this impact will mainly be exerted on the residents along Ngoc Hiep commune road. On Chu Dong Tu Street and the Northern bank of Cai river, the impacts of dust andexhaust gasesfrom demolition work may partially affect the visitors to the

Po NagarCham Towers (about 30-50m from the construction site). On Road No. 4, the impacts wouldmainly on residents in the areas of Nguyen Xien Street and the interchange with the railway, and the planned interchange between Road No. 4 and April 2 Street. The remaining areas along Road No. 4 are mostly vacant land with no access road and no residents.

Figure 3-5. Po Nagar Cham Towers possibly affected

Demolition work targets mainly walls, auxiliary works, and solidified works, which are to be destroyed within a short period of time, and the amount of dust generated will not betoo large. The impacts, therefore, are controllable. However, demolition is to take place in densely-populated areas or near the streets with heavy traffic (along the southern bank of Cai river, Chu Dong Tu Street, the northern bank of Cai river, and the final section of Road No. 4). Thus, demolition operations and the transportation of demolished volumes will give rise to dust and exhaust gases affecting the residents in these areas.

Impacts from dust will depend on the weather conditions. Dust will be dispersed more quickly and widely in strong winds, and will be more unpleasant during dry and hot weather.Therefore, in general, impacts from dust generated by the demolition of works are chiefly temporary, localized at low to medium levels – and controllable.

Air pollution caused by ground leveling, excavation and backfilling, and transportation:

Dust and exhaust gases will be dispersed from the processes of ground leveling, excavation, backfilling, and stockpiling and transportation of materials.

- Dust from ground leveling, excavation and backfilling: On average, dust generated from excavation or backfilling of 1m^3 of earth would be about 0.75 kg /m^3, of which 10% is suspended dust. Based on pollution coefficient E = 0.075 kg/m^3 and compliance with the subproject work progress, the loads of dispersed dust generated by excavation, backfilling and ground leveling can be forecasted as follows:

Table 3-31.Loads of diffused dust from excavation, backfilling and ground leveling (Component 2)

No.	Item	Volume of Excavating and backfilling		Construction stage (Quarter)	Dust load (kg/day)
		m3	Ton		
1	Southern Cai river bank	88,400	123,760	12	7.1
2	Northern Cai riverbank	5,430	7,602	9	0.6
3	Road No. 4	61,358	85,901	8	7.4
4	Chu Dong Tu Street	5,231	7,323	8	0.6

Note: Unit weight of soil:1,4tons/m^3

Thus, the load of dispersed dust diffused from excavation and backfilling in Component 2's items varies between 0.6 – 7.4 kg/day.

- Dust and exhaust gases from transportation: According to the standards established by 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-ton diesel vehicles will generate loads of dust and exhausted CO, SO_2, NO_2, and HC as follows: dust: at 1.6 g/km/vehicle; CO gas: 3.7 g/km/vehicle; SO_2:7.43S g/km/vehicle; and HC: 3 g/km/vehicle (diesel of 3% S). The subproject will use 15-ton trucks for transporting earth. The total passages of trucks and generated dust loads in the process of earth transportation are calculated as follows:

Table 3-32. Number of truck passages serving construction items of Component 2

No.	Item	Quantity(ton)	Construction stage (Quarter)	Truck passage (vehicle/day)
1	Southern Cai river	226,304	12	16.1
2	Northern Cai River	14,895	9	1.4
3	Road No. 4	120,972	8	12.9
4	Chu Dong Tu Street	11,011	8	1.2
	Total	373,181	37	31.6

Table 3-33. Generated Loads

No.	Item	Dust load (mg/ms)	CO loads (mg/ms)	SO2 loads (mg/ms)	HC loads (mg/ms)
1	Southern Cai River	6.0	13.8	6.9	11.2
2	Northern Cai River	0.5	1.2	0.6	1.0
3	Road No. 4	4.8	11.1	5.6	9.0
4	Chu Dong Tu Street	0.4	1.0	0.5	0.8

Forecasted results of pollution loads of dust and exhaust gases from transport means for the construction work of the subprojectis presented below:

Southern embankment and road of Cai River: The contents of pollutants within a distance of 40-80m from the construction site are as follows: The dust contents varying between 0.17-0.37mg/m^3 (compared with the permitted limit of 0.3mg/m^3); CO between 0.38-1.4 mg/m^3(compared with 30mg/m^3); SO_2 between 0.19-0.42 mg/m^3 (compared with 0.35 mg/m^3); and HC between 0.93-3.31 mg/m^3 (compared with 5 mg/m^3). The affected people will be the residents along the southern bank of Cai river

Northern embankment of Cai River: The contents of pollutants within a distance of 40-80m from the construction site are as follows: dust contents varying between 0.014-0.05mg/m^3 (compared with the permitted limit of 0.3mg/m^3); CO between 0.033-0.12mg/m^3 (compared with 30mg/m^3); SO_2 between 0.017-0.037 mg/m^3 (compared with 0.35 mg/m^3); and HC between 0.083-0.30 mg/m^3 (compared with 5 mg/m^3). The affected people will be the sight-seeing visitors to Po Nagar Cham Towers close to the area of Cai river northern bank

Road No. 4: The contents of pollutants within a distance of 40-80m from the construction site are as follows: The dust contents varying between 0.13-0.29 mg/m^3 (compared with the permitted limit of 0.3mg/m^3); SO_2 between 0.16-0.34 mg/m^3 (compared with 0.35 mg/m^3); CO between 0.31-1.09 mg/m^3 (compared with 30mg/m^3); and HC between 0.75-2.7 mg/m^3 (compared with 5 mg/m^3). The affected people will be mainly the residents in the areas of the intersection between Road No. 4 and Nguyen Khuyen Street and Nguyen Xien Street, and the final section of Road No. 4 intersecting April 2 Street.

Chu Dong Tu Street: The contents of pollutants within a distance of 40-80m from the construction site are as follows: The dust contents varying between 0.011-0.04 mg/m^3 (compared with 0.3mg/m^3); CO between 0.028-0.1 mg/m^3 (compared with 30mg/m^3); SO_2between 0.014-0.049 mg/m^3 (compared with 0.35 mg/m^3); and HC between 0.07-0.24 mg/m^3 (compared with 5 mg/m^3). Affected people will residents along Chu Dong Tu Street.

In general, the loads of dust and exhaust gases generated in the process of transporting excavated earth are forecast as being not very substantial and will be distributed evenly along transportation routes. According to calculations,outside 40m of distance, the dust and exhaust gases concentrations do not exceed the standards provided for in QCVN 05: 2013/MONRE - *National Technical Code on Ambient Air Quality*. However, it should be noted that these are the average amounts of the contents of dust and exhaust gases during the entire period of constructing the items. In reality, practical construction activities may require high concentrations of machines and equipment, and greater working intensity, which may result in pollutant contents higher than the average calculated figures and exceed the standard permitted limits.

The main transport routes for materials will be April 2 Street, Nguyen Khuyen Street, Ha Ra bridge area, Xom Bong bridge, Tran Phu Street, Nguyen Xien Street, Pham Van Dong Street, Duong Hien Quyen Street and some other internal transport routes to the South of the city. These are also main transport routes through the city and will be affected by dust. According to the results of air quality analysis in Chapter 2, the air quality in these areas is currently fairly good. Therefore, with the operation of the Subproject, the impacts of dust will be visible. However, this is not a regular impact and can be mitigated. Subjects affected by dust will be residents living along the routes. Dust pollution will hinder business-service operations as diners would choose clean places for their meals and avoid dirty places. This would lead to a drop in the number of customers, especially along April 2 Street, Bau market area, and the Po Nagar Cham Towers, which are often crowded with tourists and business establishments.

In general, the Subproject will exert impacts from dust and exhaust gases on residents, with dust concentrations likely to exceed the permitted limit when construction is at its peak. However, these impacts can be fully controlled and minimized if all necessary sanitation measures are carried out during construction work.

The impact level of dust during ground leveling, excavation, backfilling and transportation is thereby assessed as being medium.

b. Noise

Noise is normally generated from operating construction machineries and equipment (excavators, trucks, concrete mixers...), directly impacting construction workers and residents along the construction route. According to calculations presented in Table 3-7, within 15 meters, noise magnitude is over 85dB. This is the threshold to which continuous exposure would result in fatigue and unpleasant feelings. At magnitudes exceeding 90dB, noise will badly affect hearing. The impact level of noise is medium.

Table 3-34 below indicates the areas possibly affected by noise, dust and exhaust gases.

Table 3-34. Special subjects possibly affected by noise, dust and exhaust gases

	Affected objects	Construction works	Distance to construction site
1	Residents along April 2 Street	Transportation route for materials	50m
2	The Po Nagar Cham Towers	Close to construction sites for Northern road and embankment of Cai river, sewers on , Chu Dong Tu Street	30m
3	Residents along Ngoc Hiep commune road (Ngoc Hiep ward and Van Thang ward)	Close to construction sites for Southern road and embankment of Cai river	50m
4	Residents along Nguyen Khuyen Street	Near construction site of Road No. 4,	200m

If construction work is carried out at night in these areas, the noise levels all would exceed permitted limits within a radius of 200m. During the daytime, these areas will be affected by noise within a radius of 50m. The impact level of noise is medium.

c. Impacts from vibration

The construction process with the use of means and equipment can give rise to vibration in the earth foundation. Such vibration is transmitted along the earth environment but is strongly reduced in proportion with distance.According to Tables 3-9 and 3-10: the impact level from vibration is as follows: in site clearance process of Component 2, a large number of heavy construction machines such as compactors, bulldozers, and trucks will be used for constructing the embankments, dikes and traffic roads.Demolition and site clearance may cause vibration affecting neighboring houses (mainly in the densely populated areas along the southern bank of Cai river and Chu Dong Tu Street), posing risks of cracks and breakage. The impact level is assessed to be medium.

During construction, impacts from vibration generated by operating machines on residential houses will be much reduced owing to the fairly great distance from the site (at least 40m). The impact level is assessed to be low.

B.3.2.2.2. Wastewater Pollution

a. Wastewater

About75 to 200 workers would to be mobilized for the construction of the embankments and roads on the southern and northern banks of Cai river, Road No. 4, and Chu Dong Tu Street. Thus, at peak time, a total of 435 workers will be working in all packages of the subproject if all the construction items are to be implemented at the same time. The contractor will prioritize recruiting local workers, which would help cut down the amount of wastewater from domestic activities that might be generated in the construction site. Định mức sử dụng nước theo TCXDVN 33:2006 là 165l/người.ngày. The contractor will prioritize hiring local workers to reduce the numer of workers staying on site as well as to reduce volume of domestic wastewater

generating from workers' activities.The volume of wastewater is calculated at 90% of the amount of water consumption. Based on the mentioned number of workers and aforesaid wastewater generation coefficient, the volumes and loads of domestic wastewater can be forecasted as presented in Table 3-35below:

Table 3-35. Generated domestic wastewater

No.	Item	Number of workers (person)	Wastewater volume generated (m^3/day)
1	Southern embankment and road of Cai river	200	9.9
2	Northern embankment and road of Cai River	75	3.7
3	Road No. 4	100	5.0
4	Chu Dong Tu Street	60	3.0
Total		435	21.6

Wastewater from domestic activities would contain many suspended solids, organic matters, nutrients and microorganisms.

The total volume of domestic wastewater generated from construction will be about 21.6m^3/day.Without proper management, domestic wastewater will pollute land, water, and air environment, and create favorable conditions for pathogens to proliferate. These, in turn, will adversely affect the health of communities and workers. With the construction duration of 12 and 8 quarters, the total volume of wastewater generated will be 1872 m^3 and 9,266 m^3 respectively. This amount of wastewater is large, which presents high risks of pollution from microorganisms, BOD5, and ammonium, especially to Cai river area in case such source of wastewater is directly discharged into the environment. Contractors would need to work out measures to manage this volume of wastewater.

The impact level of wastewater is assessed to be medium.

b. Stormwater runoff

The volume of stormwater runoff at the sites of Cai embankments, Chu Dong Tu Street, and Road no.4 will be substantially large (219-334m^3/day). Without proper measures of flow diversion, this volume of runoff would cause greatimpacts by flushing away construction materials, stone, sand, and garbage, polluting the surrounding area and would affect the turbidity of Cai river. The impact level is assessed to be medium.

B. 3.2.2.3. Solid Waste

a. Excavated soil during construction

Earthwork (excavation, backfilling, and dredging) will be carried out during the construction of roads and embankments and will generate a volume of waste as follows:

Table 3-36. Volume of Excavating and backfilling (Component 2)

Item	Southern Cai riverbank	Northern Cai riverbank	Road No. 4	Chu Dong Tu Street	Total
Volume of excavating/dredging(m^3)	84,400	5430	21,551	2,626	118,007
Volume of Backfilling (m^3)	30,288	-	39,807	2,605	72,700

Thus, the total volume of excavated soil in the course of construction is 118,007m^3 (approximately 165,210 tons), with a volume of vegetation to be cleared off being about 1.8

tons over a total area of approximately 17,673 m^2 of agricultural land to be cleared (generation coefficient of vegetation biomass estimated at 0.1 ton/ ha).The volume of backfill is about 72,700 m^3.

According to results obtained from the analysis of quality of mud and soil in the area, all analysis parameters have met the national standards on heavy metal concentrations in soil (QCVN 03-MT: 2015/BTNMT). However, there are some areas where the soil has been salinized,specifically dredged sludge from Cai river and from the area of the WWTP, with a total extra amount of about 94,000m^3. Without proper management, the amount of salinized soil can exert negative impacts on the soil environment and crops. This amount of 94,000m^3 of dredged sludge, if gathered in the construction site along Cai river at the same time, would fill up an area of 1.9 ha to a height of 5m.This would seriously damage the city's beauty, and mal odors from the sludge gathering area would affect the residents along Cai river (about 30m from the construction site). Therefore, this amount of dredged sludge needs to be partially transported and temporarily gathered on the construction site at a limited height of only 1.5m.

This volume of soil will be transported and disposed of for ground leveling in the site planned for the Administrative and Urban Center of Khanh Hoa province. As indicated before, the salinity of groundwater in the region is 2.6‰ and that of the soil is 2.7‰, which is similar to the salinity of the sludge dredged from Cai river. This would, therefore, limit salinity impacts on the surrounding environment.The transportation of the wet dredged materials to the disposal site would cause water and sediment leakage and drop onto the route along April 2 Street – Le Hong Phong Street– Phong Chau Street, which are densely-populated areas on both roadsides with heavy traffic. Therefore, this quantity of saline soil will be left to dry off and then transported to the designated disposal site in closed container trucks to prevent leakage and drop on the way.

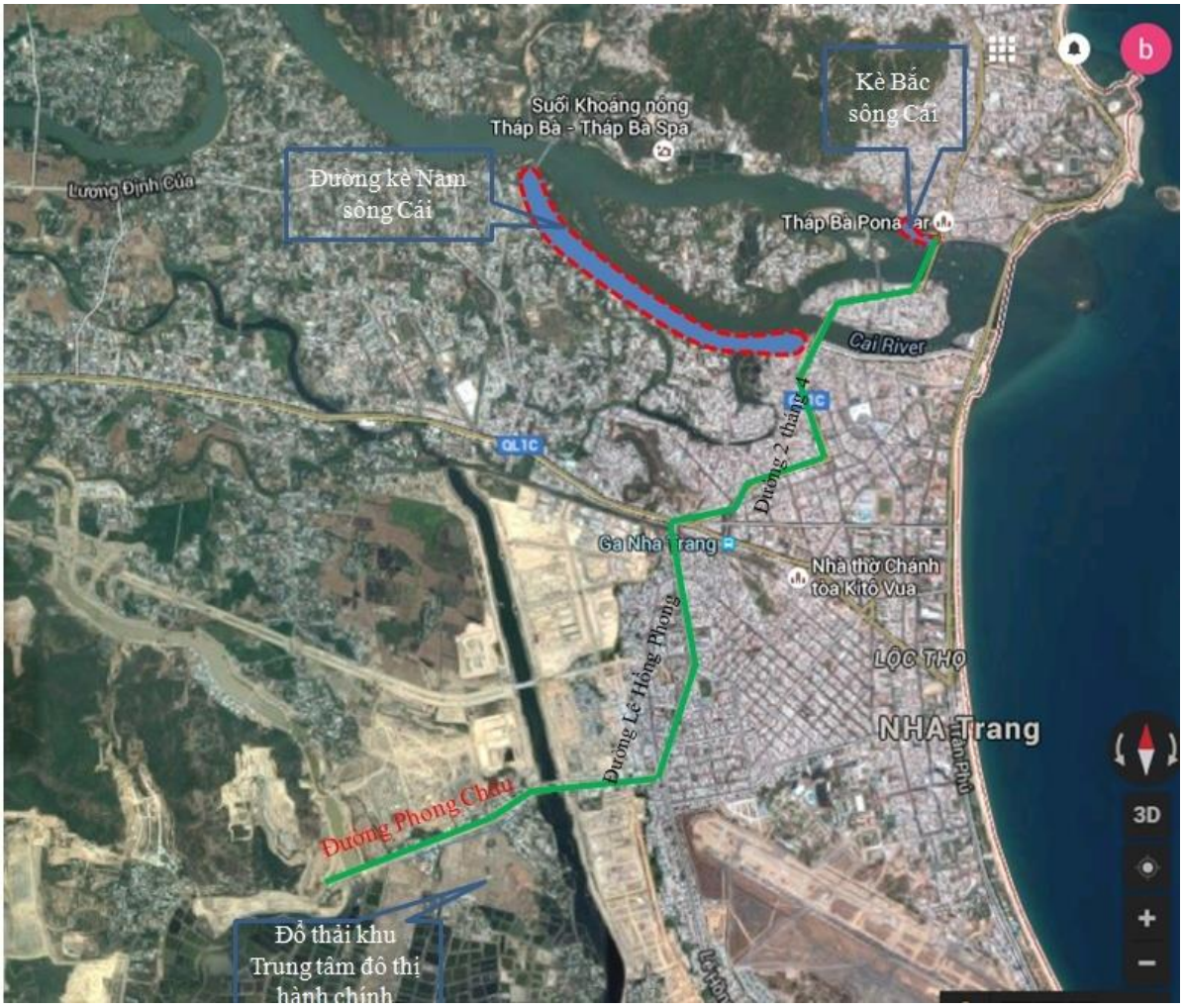


Figure 3-6. Transportation route to disposal site at Administrative and Urban Center

As for normal excavated soil, the subproject will coordinate with other agencies to use this excavated soil in ground leveling. Otherwise, this excavated soil must be disposed of in Luong Hoa Landfill. If this volume of excavated soil is gathered on site, heavy rains can sweep it away, thus increasing the turbidity of stormwater runoff and heightened the risk of sedimentation in the drainage conduit. These excavated materials can be temporarily stored in a landfill cell for later use as covering materials by leveling it out after each day.

The impact level of excavated soil during construction is assessed to be medium and requires strict management measures.

b. Domestic waste

The number of workers at the camps on the construction sites would be 132if all the packages are carried out at the same time. This would generate about 0.5 kg of domestic waste/person/day[9],i.e. 66kg/day. Accordingly, with respective construction durations of 12 and 8 quarters, the total amount of generated waste will be 5.6-28.1 tons. Without proper management, such amounts of generated domestic waste would become a polluting source, giving rise to bad smells and pathogenic factors from microorganisms. However, the workers will be located at four different construction site, and therefore, the impact level is assessed to be low.

[9]Prof. Dr. Nguyen Van Phuoc, 2008. Documents on management and disposal of solid waste

c. Construction waste

The amount of solid waste generated from the demolition of existing houses along the Southern embankment road of Cai river, the Northern embankment road of Cai river, and Chu Dong Tu Street is estimated at about 18,000 tons.

Construction waste from the construction process would include used construction materials such as cement bags, residual iron and steel scraps, wood chips, empty cartons and boxes, etc. Without proper collection and recycling, these would have negative on the environment and be wasteful. This type of waste is composed of inert and non-toxic substances, some of which can be recycled or re-used for other purposes. The impact level is assessed to be low.

The Construction area in Chu Dong Tu Street will be 5,110 m^2 at that in Road No. 4 at the section along the railway is 36,560 m^2. Theconstruction area for the Southern road and embankment on Cai riveris 55,608m^2, while that for the Northern road and embankment on Cai river is 7,236m^2.Construction will last 3 years.

Thus, the amount of generated construction waste will be:

(5110+36560+55.608+7.236)*0.1/(3*365) = 9.54 m^3/day.

And the total amount of waste generated during construction will be 10,446 m^3. This amount of waste is also proposed to be sold out to scrap trading units for recycling and reuse. The impact level is assessed to be medium.

B.3.2.2.4. Hazardous waste

Hazardous waste generated from the subproject implementation would include waste grease and oil, oily rags, and empty oil/grease containers. The average amount of grease and oil discharged from machinery and equipment is 7 liters/each change. Oil change and maintenance of machines-equipment are scheduled every 3 months at the most. The number of vehicles and construction means needing oil changes and mainly used in the Subproject is 49 (including 14 trucks and 35 construction means). The amount of waste grease and oil generated in the construction site therefore averages (49 x 7 liters/time)/3 months = 114 liters of oil/month. In addition, the subprojectwould also generate about 50 kg of oily rags and containers per month.

Without appropriate management, these types of construction waste would have negative impacts on the soil, water, and air environment; residual grease and oil in containers can penetrate into the ground, causing soil pollution. The impact level is assessed to be medium.

B.3.2.2.5. Impacts On Aquatic Species And Terrestrial Ecology

Aquatic species in Cai River:

The dredging of the Southern and Northern banks of Cai river will exert impacts on aquatic species in this area and disturbing their habitat when the water flow at the construction section becomes more turbid and partly filled with soil and stone, resulting in unwanted changes in the bottom sediment layer and photosynthesis and visibility reduction.Information on the current status of aquatic species in this area is still limited as there has been nearly no research study owing to a lack of available documents and limited time and budget. However, through information gathered from local people living along the riverbank and with reference to survey and field analysis, there is no endemic aquatic species in the area or any species on the Red List. The ecological environment along the Southern and Northern banks of Cai river have significantly been disturbed by wastes and wastewater discharged directly into the river from the many restaurants located along the Southern riverbank, waste and wastewater fromthe shipyard,and wastewater from the canal ofSon Thuy area. Therefore, this section of the riveris not regarded as benign for natural aquatic species and habitats. Within the distance of 500m-

1,000mfrom the construction sitesfor the Northern and Southern embankments of Cai river to the estuary,the main polluting factors consist of suspended solid particles of small sizes, almost all of which will be settled down onto the riverbed before making their way to the estuary. The degree of impact from the subproject on aquatic life therefore can be regarded as low. During construction, the subproject will also apply suitable measures to control pollution in order to avoid or mitigate undesirable impacts on the quality of water and aquatic species in Cai river.

Impacts on Nha Trang Bay and Hon Mun Island: This is a rich ecosystem with such species as *Sonneratia Alba*, red mangroves, black mangroves, *Avicennia Alba*, seagrass, and coral reefs. However, as this area is located about 13-17kmoffshore from the subproject area, and thus there will be no impacts on this ecosystem.

Impacts on the beach along Tran Phu Street: The nearest beach area is about 3km from the construction sites (the Northern and Southern embankments of Cai river) of the subproject. The suspended solid particles of small sizesgenerated by construction activities can settle within the travelling distances of 300-400m and are unlikely to reach the sea. Therefore, there will be no impacts on marine species in this area and the beach.

Some other critical habitats like Nha Phu Lagoon, Cam Ranh Bay, Thuy Trieu Lagoon, Van PhongBay, and Hon Ba Nature Reserve are all located about15-80km from the project sites.Therefore, the subprojectwould not have any impacts on theseimportant ecosystems.

Impacts on terrestrial ecology:

The subproject area is covered with only wild plants such as grass, water lettuce, nipa palms, etc. in the construction area of Road No. 4. A number of plants have been grown by residents(flowers, nipa palms, tropical almond, etc.)on the Northern Cai river bank. The common animals are such rats and frogs. It can be concluded that the subproject area has no biodiversity value, and thus the impacts on terrestrial ecology would be negligible. The impact level is assessed to be low.

B.3.2.2.6. Impacts On Urban Landscapes

As mentioned, construction activities will require soil excavation and road demolition (construction of roads and embankments on the Northern and Southern banks of Cai river, Chu Dong Tu Street, etc.) and the setting up of wall fences for the construction sites. These operations will temporarily change the landscapes and affect urban beauty. As the construction site for the Northern embankment of Cai river is close to the Po Nagar Cham Tower, the concentration of machines and equipment and the gathering of materials will partially affect the general beauty of the site.

The level of impact on urban beauty and landscape is assessed to be low.

B.3.2.2.7. Impacts On Water Quality

The dredging of the Northern and Southern banks of Cai River will generate an amount of suspended solids which would be brought toward the river estuary if there are no reasonable controlmeasures.However, it is not likely for these suspended solids to travel very far as they will settle down onto the riverbed within a distance of 300-400m. As the construction site of the Northern and Southern banks of Cai river is located from 500m to 1,000m from the estuary, suspended solids in the river flow will not pose a threat to the estuary.

Stormwater runoff washing over the subprojectarea will bring along pollutants including construction materials, soil, sand, grease waste and pour into Cai river, affecting its water quality.

There are no hydraulic works or water supply works along the river section between the railway bridgeand Ha Ra bridge. Meanwhile, Vo Canh water plant is about 11km upstream the railway bridge, the subproject construction areas. Therefore,no impact on the water supply plant is expected.

Another factor bound to cause water source pollution is domestic waste and wastewater from workers' camps, specially at the construction site of Cai river's Southern road and embankment, Chu Dong Tu Street. This source of pollutants (estimated at 1.4-4.5 m^3/day), without good management, would be discharged directly into rivers and creeks and cause organic pollution (BOD, COD) and nutrient pollution (N, P) to the receiving waters.

The impact level is assessed to be medium.

B.3.2.2.8. On-Site Flooding

In the area for construction on Road No. 4, may be affected by water flow from Hon Kho mountain. During construction, backfilling and foundation bed heave of the route may partially impede drainage from BacVinh Hai area to the West of the railway, flooding the area in heavy rains. Therefore, construction measures must take into account this risk to ensure timely drainage and avoid flooding in the area.The impact level is assessed to be medium.

B.3.2.2.9. Traffic Disturbances, Increased Traffic Risks

Road traffic: It is estimated that, during construction on the Southern bank of Cai river, Road No. 4, and Chu Dong Tu Street, there will be an increase of the amount of vehicles transporting raw materials and waste for disposal at 31times/day on average. The trucks transporting materials will travel along April 2 Street with heavy traffic and the Po Nagar Cham Towers frequented by lots of visitors. Therefore, this increased traffic will be likely to result in high risks of traffic accidents and jams on this route, especially during rush hours. The impact level is assessed to be medium.

Waterway traffic: The construction site for the Southern and Northern embankments of Cai river would occupya small part of the river width (about 5-10m width against the 300-400m width of Cai river). In addition, this is the mooring place of some small fishing boats, so the impacts on waterway traffic would be: (1) hindering the movement of some small boats, and (2) risks of waterway accidents. The level of impact on waterway traffic is low.

Railway traffic: Special attention must be paid to railway safety during construction in Road No.4 to avoid serious losses in human lives (for both railway passengers and workers) and properties.Two noteworthy locations along the railway route are the areas of Nguyen Khuyen and Nguyen Xien intersections. These are areas with relatively heavy traffic. Heavier traffic with transport vehicles traveling into the construction site for Road No. 4 may raise the risks of railway accidents. Compliance with traffic rules, traffic signs and train warning signals are highly recommended.The impact level is assessed to be medium.

B.3.2.2.10. Social Impacts Related To Construction Activities

Impacts on community relations and social structure:

It is estimated that about 200workers would be required for construction of the Southern embankment and road of Cai river;75 workers for construction of the Northern embankment of Cai river; 100 workers for the construction of Road No. 4; and 60 workersfor the construction onChu Dong Tu Street. Thiswould increase the risks and give rise to: (i) potential impact of spreading infectious disease from workers 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; (iv) communities could be at risk if they travel around or are close to the construction sites and potentially exposed to

accidents. However, with the shortage of labor for the construction, local workers in the city will have the opportunity to participate in the construction. The vendors and supermarkets near the construction will also benefit during subproject implementation. Therefore, these impacts are considered moderate impacts to the local communities.

B.3.2.2.11. Erosion and Sedimentation

The making of a retaining dike 3-5m from the banks during construction may reduce the flow cross-section, causing the flow velocity to increase.This may result in erosion and sedimentation in both river sides. However, according to the field survey, as the river width is relatively large (300-400m) and the distance from the retaining dike to the bank is fairly small compared with the river width, the increase of flow speed, if any, is not very significant. The scope of impact can be seen as very low. The impact level is assessed to be low.

B.3.2.2.12. Health and Safety Risks to Workers and Communities

a) Impacts oncommunity health and safety

Demolition and site clearance: Many of the works (about 72 houses) along the southern bank of Cai river and Chu Dong Tu Street are to be demolished. As this is a densely-populated area, demolition operations may give rise to risks of accidents to both residents and demolition workers. In the construction area on Road No. 4 (Component 2), the risk of accidents to communities is lower as most of this area is vacant land, only a few houses(70-150m from the construction site).

During the construction stage, with more construction workers (about 200 in the area of the Southern embankment and road of Cai river, about 75 in the area of the Northern embankment of Cai river, about 100 in the area of Road No. 4, and about 60 persons in the area of Chu Dong Tu Street) and free migrants participating in construction or other services, the health care stations will face more difficulties in diagnosing and treating diseases and providing healthcare for communities in case of arising diseases and epidemics. Various and operations would generate domestic wastewater and waste, and the growth of services, breeding activities carried out by households, workers and nonresidents coming to join in providing services 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. Increased contraction of HIV/AIDS and other sexually transmitted diseases, especially through prostitution, pose great risks normally related to large-scale construction subprojects.

As the areas along the Southern bank of Cai River, Chu Dong Tu Street, and April 2 Street are thickly populated, contractors and construction units will have to pay proper attention to the risks of traffic accidents to people in using mechanized means in the construction process. During construction, there will be a need of about 50.5 trips of subproject vehicles per day. Operations using transport trucks must be guided by proper staff whenever the vehicles run through residential areas. Construction signs must be placed at designated positions. Vehicles must travel at safe speeds. And the construction site must be properly illuminated during night time.

The impact level is forecasted to be from low to medium.

b) Impacts on worker health and safety

Getting into frequent contact with machinery, means and equipment, workers would be regularly exposed to noise and dust at the construction site. In addition, there may be other risks from direct contact with cement and some other hazardous substances such as paints, oils

and fuel, which are likely to cause skin corrosion or additives which may penetrate into the body through the skin. Also, the storage and/or use of electricity and gases in the worker camps can give rise to risks of fire and explosion, claiming lives and endangering workers' health

The construction areas for the Northern and Southern embankments of Cai River: flooding downstream Cai river discharging to Ha Ra estuary may also affect the construction of the embankment. Floods in Cai river normally occur in October-December, possibly in May-June, with each lasting 2-5 days and witha flow accounting for 82% of the annual flow. Therefore, the construction of the embankment during these times may encounter difficulties with high risks of labor accidents. The construction contractor will have to be fully aware of this for working out suitable construction schedules. The impact level is assessed to be from low to medium

B.3.2.2.13. Impact on Existing Infrastructure

Impact on traffic infrastructure

Railway infrastructure: Road No. 4 will be constructed in parallel with the railway, about 15m from the foot of the slope in accordance with regulations on railway safety corridors. Therefore, the construction of Road No. 4 will not affect the railway infrastructure.

Roads: The local traffic infrastructure could be impacted due to operation of transport vehicles (material, waste, and mixing concrete transportation) which could degrade local roads. The roads potentially affected by the subproject transportation activities include April 2 roads for construction of the embankments; April 2, Ngo Den roads for construction of Chu Dong Tu street, and Nguyen Khuyen, Nguyen Xien, April 2 roads for construction of Road No. 4. However, due to the medium scale, widely dispersed construction, medium transportation demand (about 50 vehicle/day), and most of the transport routes are urban road with good quality, therefore the impacts will medium. However, to ensure control over the types of impacts, the mitigation measures need to be proposed and complied during construction time. If degradation of local roads/streets results from the component, the contractors and PMU would be required restore the roads/streets to their condition prior to construction

The impact level is assessed to be medium.

Impact on telecommunications infrastructure (telephone and Internet cables): As there is no telecommunications infrastructure in the areas of Road No. 4 and the northern embankment of Cai river. Project construction will not affect telecommunications works. Impacts will take place only during the demolition of houses along the route, and there will be no impact during the construction process. Overhead Internet or telephone lines may be broken when machines are used in demolition work. The impact level is assessed to be low.

Impact on wireless cables: None

Water supply infrastructure: Excavation of the roads for the sites of the embankments of Cai river and Chu Dong Tu Street may pose risks of breakage of water supply pipelines to into local households.

Impact on power supply infrastructure

Demolition work(of about 125 houses)in the areas of Chu Dong Tu Street and Road No. 4 (mainly at the intersection between Nguyen Xien Street and the railway and at the intersection with April 2 Street in Vinh Hai ward), and the Southern embankment road of Cai river will require power cut-off so as to ensure safety during the work. Power cut-off is bound to disturb the people's daily-life activities or negatively affect households providing food and drink services. The Subproject should work out measures to mitigate the impact from power cut-off.

As the construction area for Road No. 4 (section of Nguyen Xien Street intersecting with the railway) is in the corridor of power supply to local households (about 15m away), any malfunctioning or damages of construction equipment such as excavators and cranes may break electrical connectors or damage electrical poles, affecting power supply and causing safety risks. Risks relating to electrical safety and power supply can be avoided through construction methods

The impact level is assessed to be medium.

Figure 3-7. Power line in construction area near designed Road No. 4

B.3.2.2.14. Impacts on Cultural, Historical, and Religious Works

The subproject will not exert any major infringements on these works. Nevertheless, the construction process of different items will be likely to affect part of these works' activities, including the inconvenience of access that residents and tourists might have when they want to visit these places; smoke and dust may become a nuisance to visitors and construction work may affect tourism activities with risks of accidents. Cultural and religious works that can be affected by the subproject operations are listed in the table below.

Table 3-37. List of affected cultural works under Component 2

	Subproject activity	Sensitive PCRs	Potential impacts
1	- Embankment on the Northern bank of Cai River - Construction of Chu Dong Tu road	- Po Nagar Cham Towers (Located 40-70m to Chu Dong Tu road construction site, 50m to embankment construction site on the North bank of Cai river)	- Increased exhaust gases, dust, noise, vibration, construction wastes, and the risks of traffic and construction accidents to tourists and local communities, especially during the festive time from 20th – 23rd of the third month of the lunar calendar.
2	- Construction of Southern embankment and road of Cai River	- Pho Te pagoda, 300m to embankment construction site on the Southern bank of Cai river - Thien Hau pagoda, 100m to embankment construction site on the Southern bank of Cai river	- Sensitive time: 1st and 15th days every month, Buddha Day (Vesak Festival) - Impacts: Increased exhaust gases, dust, noise, construction wastes, and the risks of traffic and construction accidents to tourists and local communities, especially during the religious events
3	- Construction of Chu Dong Tu Street - Construction of embankment road on the north Cai River	- Truc Lam Thien Tu Pagoda, 50m to construction site on the Chu Dong Tu road, 20m to embankment construction	- Sensitive time: 1st and 15th days every month, Buddha Day (Vesak Festival) - Impacts: Increased exhaust gases, dust, noise, construction wastes,

	Subproject activity	Sensitive PCRs	Potential impacts
		site on the northern bank of Cai river	and the risks of traffic and construction accidents to tourists and local communities, especially during the religious events.
4	- Construction of embankment road on the north Cai River	- Ngoc Thuy Vihara (close to the site for constructing the southern embankment on Cai river)	- Partial acquisition of land area of Vihara(mainly toilets and auxiliary works); - Impacts: Increased exhaust gases, dust, noise, construction wastes, and the risks of traffic and construction accidents to tourists and local communities, especially during the religious events, and impact on landscape of the Vihara
4	- Construction of Road No. 4	- 2 graves	- 2 graves to be moved

B.3.2.3. Operation Phase

B.3.2.3.1. Embankments and Roads along Cai River

The construction of the embankments and roadson the Northern and Southern banks of Cai River will affect the flow mechanism of the river. According to the subproject's calculations of the similar levels of Cai river, after the embankments have been completed, the water level of Cai river may increase downstream the railway bridge during floods.However, according to results obtained from the simulation model, the entire area of Cai River will not be flooded when the embankments have been completed. Moreover, the constructed embankmentswill also help limit erosion of the river bank, thus securing local people's safety and livelihood.

B.3.2.3.2. Impacts OnTraffic Roads

(i) Flooding and inundation possibility

Road No. 4: At present, water in this area is drained from the natural terrain through the railway. The construction of Road No. 4 in parallel with the railway will obstruct this natural drainage direction. However, drainage sewers are designed under Road No. 4 and the subproject has also planned a balancing lake in this area for draining stormwater. Flooding in the area is therefore almost unlikely to happen.

(ii) Traffic safety on Subproject's new roads

The completed roads will help reduce traffic loads for such routes as April 2 Street (at the intersections with the Southern and Northern roads of Cai River, Chu Dong Tu Street, and Road No. 4), Nguyen Xien Street, and Nguyen Khuyen Street (at the intersection with Road No. 4). However, when the density of traffic on the new roads increases, the traffic risks on these roads also increase accordingly. Traffic signboards will be placed in accordance with regulations at the intersections on these roads to minimize traffic risks. However, control oftraffic accidents during operation is beyond the scope of the subproject and will be undertaken by relevant line agency department of the city.

B.3.2.3.3. Indirect Impacts

Chu Dong Tu Street, Road No. 4, Northern and Southern embankment roads of Cai River:

The completion of these traffic roads will entail the growth of business services along the routes. This will contribute to increasing the amount of solid waste in the areas around these routes.

Increasing traffic density on these roads will also contribute to increased amounts of smoke, dust and CO2.

B.3.2.4. Assessmentand Forecast of Impactsofrisks and Incidents

B.3.2.4.1. Pre-Construction Phase

Risksof incidents during this period are mainly related to accidents and labor safety in demolition for site clearance which is assessed as minor.

B.3.2.4.2. Construction Phase

Risks to public health: The large number of construction employees will require well-planned arrangements and organization; otherwise, their health would be badly affected and diseases/epidemics would break out, threatening the surrounding and local residents.

*Risks of short circuiting,fire and explosion:*These risks may materialize and incidents take place with power consumption devices in the construction site and in workers' tents and camps, especially with the risk of lightning strikes on thunderstorm days and due to workers' negligence in using electrical devices; storage yards of raw materials and fuel (paints, gasoline, diesel oil, fuel oil...) may provide sources of fire and explosion. The impact is assessed to be medium.

*Risks of earthquakes:*The possibility of earthquakes is very low. However, once taking place, such incident would cause a huge impact on the environment. The subproject will pay attention to this kind of risk in the design of construction works.

*Risks of natural disasters, hurricanes and floods:*Natural disasters, hurricanes and floods may be inevitable and would cause significant impacts on the environment as well as humans. Each year about 2-3 storms would land onto Nha Trang between October and November, with Vinh Phuoc, Ngoc Hiep (embankment construction) being most seriously affected. During implementation, the subproject will work out plans for construction works associated with the program on managing and monitoring the environment at each stage in order to minimize the environmental impacts from natural disasters, hurricanes and floods.

*Possible discovery of relics and archeological items:*In the process of dredging the areas in the Southern and Northern banks of Cai river, Chu Dong Tu Street, and Road No. 4, relics and archeological items may be unearthed and discovered, especially at the Northern bank of Cai river being a more promising archeological site than the Southern bank as it is located close to the relics of Po NagarCham Towers. It would be a great loss for the country's culture, archeology and even tourism if these relics and archeological items are lost or damaged. Therefore, the subproject will have to devise a handling process once such relics and archeological items are uncovered during construction to avoid losses and damages of the same. The impact level is assessed to be low.

B.3.2.4.3. Operation Phase

a. Traffic accidents

The completion of Chu Dong Tu Street, Road No.4, and the Northern and Southern embankment roads of Cai river will entail increased traffic flows in such areas, thereby increasingthe risks of traffic accidents.

Those positions with highest risks of traffic incidents will be:

- The interchange of Chu Dong Tu Street- April 2 Street – Xom Bong bridge – Northern embankment road of Cai river due to heavy traffic and its proximity to the Po NagarCham Towerswhich are frequently crowded with visitors.
- The interchange of the Southern embankment road of Cai river – Ha Ra bridge – April 2 Street due to heavy traffic flow on April 2 Street.
- The area where Nguyen Khuyen Street intersects with the railway and Road No. 4 and the area where Nguyen Xien Street intersects with the railway and Road No.4 withaccident risks related to railway transportation.

The impact level is medium.

b. Risk of embankment slides and collapse

Embankment slides would directly affect the quality of the works and reduce the capability of controlling hurricanes and flooding and the capability of mitigating natural disasters of the embankment route. Embankment slides would also impact the landscape and the environment in the area.The impact level is assessed to be low.

C. SUBPROJECT SITE SPECIFIC IMPACTS

Table 3-38. Site-specific impacts on each sensitive receptors

No	Sensitive receptor	Relation to subproject activity	Site-specific impacts
Site clearance stage			
1	Community House of Xuan Ngoc hamlet – Vinh Ngoc Ward	- Related to the construction of the northern WWTP (Component 1) 	- Acquisition of 777m^2 of the total 2,828 m^2 of land area including the entireCommunity House - Lossof a common place for community meetings, events, and socialization
2	Vinh Ngoc Primary School	- Related to the construction of the northern WWTP under Component 1 	- Acquisition of341m^2 of the total 5,588 m^{2}of land area includingacquisition of part of the school yard and part of the fence - Partial loss of pupil's playing ground - Exhaust gases, dust and noise, and wastes affecting pupils' health - Increased risks of traffic accidents due to construction transportation - Lessons affected by noise
3	2 graves in Vinh Hai Ward	- Related to the construction of Road No. 4 under Component 2	- Two graves will be relocated. To Vietnamese people, grave is the spiritual matters which should be respected carefully. Household and individual graves are considered physical cultural resources (PCR), and the Bank's OP/BP 4.11 applies

			for this subproject. The level of this impact caused by this activity is only small and localized
Construction stage			
4	Po Nagar Cham Towers	- Related to the construction of the stormwater and wastewater drainage systems on April 2 Street, and at PS2, PS3, CSO3 in Component 1: 30-100m from the stormwater and wastewater drainage line on April 2 Street; 150m from PS2 and CS03; 80m from PS3. - Related to the construction of roads and embankments on the northern bank of Cai river, and Chu Dong Tu Street in Component 2: 40-70m from Chu Dong Tu street construction site; 60m from construction site northern embankment of Cai river under Component 2. 	- Increased dust and exhaust gases due to construction activities affecting the visitors; - Increased risks of traffic accidents due to construction transportation - Temporary degradation of the landscape around the towers - More difficult access to the relics and possible traffic jams on April 2 Street section near Po Nagar Cham Towers - Increased construction wastes, waste water - Conflicts between workers and visitors
5	An Ton Church	- Related to the construction of stormwater and wastewater drainage system on April 2Streetunder Component 1; 10m from the construction site. 	- Hindrance to access to the church - Increase in dust and exhaust gases, affecting visitors to the church - Increased construction wastes, waste water - Temporary degradation of the landscape - Risks of traffic accidents and community safety due to construction - Localized flooding becasue of construction during rainny days - Conflicts between workers and visitors to the church
6	Bau market	- Related to the construction of stormwater and wastewater drainage system on April 2Streetunder Component 1;	- Localized flooding in market area due to construction activities - Risks of construction accidents totraders and customers - Interruption of business activities

			- Increased dust and exhaust gases, affecting market activities and goods - Traffic safety risks to the community, especially at night - Conflicts between workers and traders and customers.
7	Ngoc Thuy Vihara	- Related to the construction of the southern embankment of Cai river of Component 2; 20m from the construction site 	- Partial acquisition of land area of Vihara(mainly toilets and auxiliary works: 443/2184 m2); - Increased waste, dust, and exhaust gases due to construction activities affecting visitors to the Vihara; - General landscape of the Vihara - Vibration caused by the construction machineries may affect the existing structures of monastery - Potential risks of traffic safety due to construction transportation
8	Ba Lang Parish	- Related to the construction of stormwaterand wastewater sewers in Duong Hien Quyen (20m away), Pham Van Dong Street (50m away), pumping stations PS1 (50m) of Component 1 	- Affecting the landscape owing to gathering of construction materials - Increased wastes, wastewater, dust, and exhaust gases affecting people going into the parish - Potential risks of traffic safety for the church goers due to construction transportation
9	Vinh Hoa 2 Primary School	- Related to the construction of school sanitation block (Ngo Van So Street), the construction of stormwater and wastewater sewer line in Ngo Van So Street, pumping station PS4 (20m away) of Component 1. 	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting pupils' health - Lessons affected by noise and vibration - Risks of traffic accidents to teachers and pupils due to construction transportation and other activities

10	Mai Xuan Thuong Lower Secondary School	- Related to the construction of wastewater drainage system on Mai Xuan Thuong Street, 20m away) under Component 1 	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries may affect wall, gate of school - Potential localized flooding caused construction during rainny days
11	Sao Bien Pre-School	- Related to the construction of wastewater drainage system in Mai Xuan Thuong (20m away) underComponent 1 	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries may affect wall, gate of school - Potential localized flooding caused construction during rainny days
12	Vinh Hoa 1 Primary School	- Related to the construction school sanitation blocks (Dien Bien Phu Street), the wastewater drainage line on Dien Bien Phu Street (20m away) of Component 1. 	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries may affect wall, gate of school
13	Vinh Tho Primary School	- Related to the construction school sanitation block (Ton That Tung Street) of Component 1	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries may affect wall, gate of school
14	Vinh Hai 2 Primary School	- Related to the construction school sanitation block (Nguyen Khuyen Street) of Component 1	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health

			- Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries may affect wall, gate of school
15	Market at Duong Hien Quyen and Dien Bien Phu intersection	- Related to the construction of wastewater drainage pipeline on Dien Bien Phu Street and Duong Hien Quyen Street (10-30m away) of Component 1 	- Increased dust, exhaust gases, noise, vibration, construction wastes, hazardous waste, domestic wastes, and wastewater due to construction activities affecting the market foods and product for the local people. - Clogging of local drainage canal leading to localized flooding. - Increased traffic congestion and risks of traffic accidents due to construction and transportation. - Hindering of access by the customers to the market due to construction activities affecting income of the business people. - Conflicts between workers and traders
16	Vinh Ngoc Primary School	- Related to the construction of the WWTP of Component 1 (50-100m away)	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries may affect wall, gate of school - Potential localized flooding caused construction during rainny days
17	Power Company	- Related to the construction of Road No. 4 (10m away) of Component 2 	- Increased construction wastes, waste water, dust, and exhaust gases, affecting company's staff - Increased risks of accidents company's staff from large numbers of operating machines & equipment and transport vehicles in construction site - Potential localized flooding caused construction during rainny days

18	Railway	- Related to the construction of the pressure pipeline conducting wastewater to the WWTP passing the railway of Component 1; and the construction of Road No. 4 at least 15m from the railway slope foot of Component 2	- Increased risks of railway accidents - Possibly interference with the train schedules - Risks of damage to railway infrastructure
19	Water supply pipeline	- Related to the area in front of the construction site of the WWTP, to be reinstated of Component 1 	- Risks of breakage of the water supply pipeline during road excavation, ground leveling, and construction, affecting water supply for households of Vinh Ngoc commune
20	April 2 Street	- Related to the construction of stormwater and wastewater drainage lines on April 2 Street of Component 1 - Related to the material transport route for the entire construction items of the subproject - Traffic risks: at the starting and ending points intersecting with Doan Tran Nghiep Street and Mai Xuan Thuong Street	- Typical impact:mostly related to traffic as construction operations will occupy one part of road surface, while the other part will be used for gathering machinery and storage of construction materials during construction - Inconveniences to locals' business activities as access to business establishments will be obstructed - Affecting drainage capability - Dust, waste, damagedlandscape - Risks of landslides and subsidence damages to existing works along road sides from deep excavation for the construction of pipe trench - Safety risks to vehicles and community, especially at night when excavation is performed to depths of 1.7 -2.5 m
21	Pham Van Dong Street	- Related to the construction of wastewater drainage line in Duong De-Vinh Hoa area of Component 1 - Related to material transport route for the construction of wastewater pumping station (PS1, PS3, PS4), and combined sewer overflow (CSO4, CSO5, CSO6), wastewater drainage line in Duong De-Vinh Hoa area of Component 1	- Risks of traffic accidents; - Inconveniences to locals' business activities as access to business establishments will be obstructed; - Affecting drainage capability - Dust, waste, damaged landscape - Risks of landslides and subsidence; damages to existing works along road sides from deep excavation for the construction of pipe trench

22	Areas along northern and southerns banks of Cai river	- Related to the construction of northern and southern embankments of Cai river	- Excavated salinized sludge from Cai river (94,000m^3) - Increased turbidity of river water - Risks of labor accidents to workers from drowning and flooding - Increased dust and exhaust gases, affecting people - Increased construction wastes, waste water - Affecting drainage capability
23	Nguyen Khuyen Street	- Related to material transport route for the construction ofBalancing lake, PS5, sewer connecting the balancing lake to Nguyen Khuyen, CSO1,CSO2, School sanitation of Vinh Hai Primary school No. 2, WWTP (Component 1), No.4 road (Component 2) - Ending point connecting to the railway	- Risks of traffic accident occurring on the transport routes - Impacts of dust, noise and emission affecting the health of traffic participants and residents - Risk of railway accident - Risk of damaged roads
24	Nguyen Xien	- Related to material transport route for the construction ofNo.4 road - Ending point connecting to the	- Risks of traffic accident occurring on the transport routes - Impacts of dust, noise and emission affecting the health of traffic participants and residents - Risk of railway accident - Risk of damaged roads
25	Hung Loc Hau	- Related to material transport route for the construction of WWTP, Rainwater pumping station (Component 1)	- Risks of traffic accident occurring on the transport routes - Impacts of dust, noise and emission affecting the health of traffic participants and residents
26	Dien Bien Phu	- Related to material transport route for the construction ofWastewater sewer pipeline, School sanitation of Vinh Hoa Primary school No. 1 (Component 1)	- Risks of traffic accident occurring on the transport routes - Impacts of dust, noise and emission affecting the health of traffic participants and residents
27	Administrative and Urban Center of Khanh Hoa province	- Related to the disposal area for salty soil arising from the dredging of Cai river and the digging soil of WWTP), away 4km to the dredging area - Transport route (April 2 – Le Hong Phong – PhongChau) has got high traffic density and is the densely populated area - The elevation of Administrative and Urban Center of KhanhHoa province (126ha) is currently lower than road surface of PhongChau road (about 3-	- Risks of traffic accidents occurring on the transport routes - Impacts of dust, noise and emission may affect traffic participants and residents - The disposal of salty soil would not affect the existing soil quality due to having a same salinity in two kinds of soil - No risks of subsidence and landslide for residential areas around this area - No impacts onriver water quality

		4m). There are no agricultural activities in this area due to salty soil, its distance to residential area and Quan Truong river respectively is about 200m and 500m 	
Operation stage			
28	Vinh Ngoc Primary School	- Related to the operation of the northern WWTP (100m away) of Component 1	- Possible incidents in the WWTP odor treatment system, giving rise to bad odors affecting pupils' learning activities

D. CUMULATIVE IMPACT ASSESSMENT

This section discusses the cumulative impact of the subproject. In this regard, the cumulative impact under consideration is defined as two or more individual effects that, when considered together, are considerable or which compound or increase other environmental impacts. The cumulative impact from several projects result from the incremental impacts of the proposed project when added to other closely related, and reasonably foreseeable, future projects. The impacts that do not result in part from the subproject will not be discussed.

The discussion of impact severity and likelihood of occurrence need not be as detailed as for effects attributable to the subproject alone. The analysis of cumulative effects in this ESIA focuses on the effects of concurrent construction and operation of the proposed project with other spatially and temporally proximate projects as described below. 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.

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. Geographically, the proposed subproject is located in the Nha Trang City. For the purposes of this analysis, projects in and around the subproject area are considered when evaluating potential cumulative impacts due to construction and operation of the proposed subproject. These projects are: 1) Coastal Cities Environmental Sanitation Subproject (CCESP) – Nha Trang subproject; 2) Ngoc Hiep Resettlement Site Technical Infrastructure Construction Subproject; and 3) Hon Ro 2 Resettlement Site Technical Infrastructure Subproject. They arelisted in Table 3-39.

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 identifiedbased on the avialable information on the projects completed, being impplemented, and to be executed

in the City.Table 3-40 lists the major capital improvement projectsbetween 2006 and 2022 that are included in the analysis of cumulative construction-related impacts.

Valued Ecosystem Components (VECs)

A scoping has been conducted to identify the VECs for which cumulative impacts will be assessed and managed based on review of the recently completed and ongoing investments in the project to identify possible linkages and potential cumulative impacts of existing and planned projects. A list of potential VECs have been consulted with the affected communities and the local authorities. The final VECs and their rationales are described below:

i) Water quality: Given the river embankment and wastewater treatment activities under the subproject, concurrent construction activities could result in increased erosion and subsequent sedimentation, with impacts to local drainages and/or storm drain capacity.Additionally, surface water quality could be affected by construction activities that result in the release of fuels or other hazardous materials to stream channels or storm drains.

ii) Aquatic ecosystem: Although there would be some negative impacts during construction of different projects, operation of the proposed project, together with the identified related projects in the area, would improve the quality of water discharged to Cai River and Quan Truong river. The proposed subproject would not have a cumulatively considerable impact to the aquatic ecosystem located in freshwater and marine environments.

iii) Air pollution:Construction of the subproject together with the identified cumulative projects located in the area would contribute additional dust and emissions to existing conditions in subproject area. Construction of the subproject would exceed the national standard' thresholds, and therefore would be expected to be cumulatively considerable.

iv) Traffic and health safety: Given the heavy traffic on the roads and streets, additional vehicle travels as a result of multiple projects could exposed the community to the risks of traffic accidents and community health due to construction activities. These are the issues of concern by the local communities.

v) Quality of life of the people in the project area: One of the key project objectives is to improve the lives of local communities through enhanced flood control and provision of basic services including collection of wastewater and wastewater treatment.

Assessment of cumulative impacts:

In case all the subprojectitems are to be constructed at the same time, the amount of domestic waste generatedwill be approximately 124 kg/day, while the amount of domestic wastewaterwill be 19m^3/day, 71 kg/day will be the daily amount of generated dust, and about 584,805 tons of excavatedsoil (about 130,200 tons of salinized soil of Cai river and 35,353 tons in the WWTP); the number of workers would about 825 and the number of truck trips will increase by about 88 trips/day.

Without proper management, this amount of waste would exert colossal impact on the city's landscape and would give rise to risks of widespread contamination of the environment (salinized soil), with dust affecting people and visitors and increasing the risks of traffic accidents (especially along April 2 Street with heavy traffic). Southern and Northern embankments of Cai river and Chu Dong Tu Street will be the most affected areas as this is a densely populated area with heavy density and large crowds of visitors to the relics of Po Nagar Cham Towers. For the construction areas of the balancinglake, Road No.4 (Vinh Hai ward),

and treatment plant (Vinh Ngoc ward), the impacts would be lower as this construction area is relatively large and the residential population in the area is quite sparse.

It is noticeable that these three projects are not carried out simultaneously with the CCSEP and the areas of their implementation are also quite distant from Cai river. Therefore, the subproject will not exert any cumulative impact on the water of Cai river. In addition, there are no aquaculture activities downstream the projected area in Cai river. No cumulative impacts will therefore be caused to aquaculture activities by dredging operations and the construction of the embankments long Cai river. As presented in Chapter 2 – *Current status* and Chapter 3 – *Assessment of Impacts*, Cai river section for the construction of the embankments is the section which is mainly impacted by human activities and is without any endemic species, species to be protected, migratory fishes, mangrove forests or endemic ecosystems to be conserved. The impact on the ecosystem of this area is therefore negligible. This also means that the subproject does not have any cumulative impact on the ecosystem of Cai river. With the collection inlets of the water supply plants located very far from the construction site (about 11km upstream), the subproject will also have no cumulative impact on the use of Cai river water by water supply plants.

On the basis of considering these projects, cumulative impacts can be regarded as limited as two of the three projects had been completed before the implementation of the CCSEP will be started, with only the project for Ngoc Hiep Resettlement Site being implemented within the implementation period of the CCSEP. However, the area for implementing the resettlement site project is located to the south of Cai river and the subproject's items to the south of Cai river will not be started until the project for Ngoc Hiep Resettlement Site is nearing its completion. Therefore, the cumulative impact on the water quality and aquatic ecosystem of Cai river will be negligible. The detailed cumulative impact assessment is discussed in table 3-39

Table 3-39. Cumulative impacts of related in related to the proposed subproject

1. Subproject name	**Coastal Cities Environmental Sanitation Subproject (CCESP) – Nha Trang subproject (2006-2014)**
Subproject description	Thissubprojectwas funded by the WB with an investment of 229.5 million USD, including 6 components: (1) Component 1: Drainage, flood control and wastewater collectionconsisting of 2,598m of combined sewer lines for Northern Nha Trang, 9,166m of combined sewer lines for the Southern part of Nha Trang and the central area of the City, 8,175m of sewer lines for Northern Nha Trang, 11,782m of sewer lines for Southern Nha Trang and the Central area, 30,638m of tertiary sewer lines, 10 pumping stations, 19 CSOs, 2,679 manholes; (2) Component 2: Wastewater Treatment Plants (WWTPs) including the Southern wastewater treatment plant in Phuoc Dong ward with a capacity of 40,000m^3/day and the Northern wastewater treatment plant in Vinh Ngoc commune with a capacity of 14,000m^3/day; (3) Component 3: Solid waste management; (4) Component 4: Resettlement and site clearance; (5) Component 5: Revolving Fund and School Sanitation Program; and (6) Component 6: Capacity building and Subproject implementation assistance.
Current status of the Subproject	The projectwascompleted in the 2006-2014 phase. However, as there was a lack of budget during implementation, a number of work items were eliminated from the project, including the Northern WWTP and some wastewater collection and drainage lines in Northern Nha Trang.
EIA/EMP status	The EIA/EMP of the Subproject have been approved by Khanh Hoa Department of Natural Resources and Environment and the WB. All of the social and environmental management requirements in the EIA/EMP have been followed throughout the project implementation.

Assessment on cumulative impacts	The CCESP was completed in 2014, so the construction process will not have cumulative impacts. However, the CCSEP is the subproject following the CCESP and has some related work items in order to thoroughly solve the outstanding environmental issues and guarantee sustainable development in the future: - The investment in the construction and completion of the Southern and Central tertiary sewer lines will help to collect wastewater in those areas to the Southern WWTP so as to ensure that the capacity of 40,000m^3/day (the current working capacity of the plant is 20,000m^3/day) and thoroughly solve the flooding situation in the Southern part of the city. - The more wastewater collection and subsequent treatment capacity will also help to further improve the water quality of Quan Truong and Tacrivers which are the main receiving waters of wastewater in the Southern part of the city and thoroughly solve the situation of local wastewater being directly discharged into the rivers. Thereby, it helps to indirectly enhance the quality and quantity of aquatic species in river catchments and improve the ecological environment, which ensures sustainable development in the future. - The Subproject will also implement the construction of the Northern wastewater treatment plant (WWTP) eliminated under the CCESP due to the lack of budget. Along with the constructed Southern WWTP, it will help to thoroughly solve the pollution caused by wastewater of Nha Trang city, improve the water quality of Cai river, guarantee the ecosystem quality on catchments of this river and in the whole city, and ensure the target of sustainable development. - The implementation of the CCSEP also does not interrupt the operation of the Southern WWTP. Therefore, it can be seen that the resonant impacts of the 2 subprojects are long-term beneficial impacts, guaranteeing the target of sustainable development in the future.

2. Project Name	**Ngoc Hiep Resettlement Site Technical Infrastructure Construction (2016-2018)**
Project description	This project has a total investment of US$7,051,996 VND funded by the Provincial Budget. The construction location is in Ngoc Hiep ward. The implementation duration is 2016 – 2018. The project will construct the infrastructure of Ngoc Hiep Resettlement Site with the total area of 14.36ha, including the following components: (1) Ground leveling, (2) Traffic roads, (3) Construction of stormwater drainage systems, (4) Construction of sewerage systems, (5) Domestic water supply, (6) Supply of domestic and lighting electricity, (7) Communication, (8) Green trees, (9) Traffic safety.
Current status of the project	The project has completed the Feasibility Study Report and is expected to be implemented from 2016 to 2018 at the same time as the implementation of the CCSEP. As planned, some lots under this project will be arranged for resettlement of the households displaced under the CCSEP.
EIA/EMP status	The EIA of the project has been prepared and approved by Khanh Hoa Provincial People's Committee pursuant to Decision No. 746/QD-UBND dated March25, 2016.

Assessment on cumulative impacts	If the Ngoc Hiep Resettlement Site Technical Infrastructure Construction project is to be completed in 2018, there will be few cumulative impacts with the CCSEP. The cumulative impacts at this point of time are mainly the increased quantity of travelling vehicles on April 2 Street and generation of exhaust gases and dust on April 2 Street.However, if the project lasts longer, the construction of the Southern embankment and road of Cai river will be implemented also in Ngoc Hiep ward. Then, the cumulative impacts of the 2 subprojects will include: - Increased amount of exhaust gases and dust affecting residential areas in Ngoc Hiep ward; - Increased quantity of means of transport in the ward posing potential;increased risk of accidents due to transportation vehicles for construction; - Increased amount of domestic wastewater and solid waste in the ward affecting the environment; - Security and order issues due to the high concentration of labors in the ward. Currently, under the CCSEP, there are some households planned to be resettled in Ngoc Hiep Resettlement Site. With a complete infrastructure of power supply, water supply, traffic roads, etc. and facilities to easily approach services (health, education, etc.), the people's life will be stable, mitigating social impacts of the CCSEP.

3. Project name	**Hon Ro 2 Resettlement Site Technical Infrastructure Project (2011-2016)**
Project description	This project has a total investment of US$5,763,094 VND funded by the Budget to create the resettlement land fund for cleared cases. Hon Ro 2 Resettlement Site Technical Infrastructure project is invested to be constructed on a land area of 29.36ha in Hon Ro 2 hamlet, Phuoc Dong commune, Nha Trang city (about 5km from the city center), including the following components: (1) River embankment, (2) Traffic roads and stormwater drainage systems, (3) Water supply and lighting electricity, (4) Sewerage system. Project implementation progress: From 2011 to 4th quarter of 2016.
Current status of the Project	The project has completed the infrastructure of one area (with 160 resettled lots) and handed over to the Provincial Land Fund Development Center in order to arrange on-the-spot resettlement for Subproject-affected Households. By March 2016, the project has constructed 50% of the quantity. The project is planned to be completed and put into use within the 4th Quarter of 2016. The land acquisition and compensation for this Subprojecthave been executed by Nha Trang City People's Committee so far. The compensation payment is conformable to compensation options approved at Decisions No. 198/QD-UBND dated January 25, 2011; No. 3315/QD-UBND dated October 27, 2011; and No. 4642/QD-UBND dated December 28, 2011 by Nha Trang City People's Committee. The total assistance and compensation budget is US$3,093,991. Compensation, assistance, and resettlement has been performed from March 20, 2011 to 2016 in accordance with the Laws and regulations related to compensation, assistance, and resettlement by the Government of Vietnam and by Khanh Hoa Provincial People's Committee.
EIA/EMP status	The EIA Report of the Subproject has been prepared and approved by Khanh Hoa Provincial People's Committee pursuant to Decision No. 2793/QD-UBND dated November 6, 2012.

Assessment on cumulative impacts	This project is located rather far from the implementation area of the CCSEP (5km on average). Moreover, the subproject completion time is at the end of 2016. Therefore, the cumulative impacts with the CCSEP during the construction time do not occur. Currently, under the CCSEP, there are some households planned to be resettled in Hon Ro 2 Resettlement Site. With a complete infrastructure of power supply, water supply, traffic roads, etc. and facilities to easily approach services (health, education, etc.), the people's life will be stable, mitigating social impacts of the CCSEP.

The assessment of the significance of the cumulative effects of projects on the VECs, by order of magnitude, is presented in the Table 3-40 below:

Table 3-40. Screening of cumulative environment impact of CCSEP

Key factors	Development activities in Project area							Overall score
	2006-2016 (completed)		2017-2018(On-going)		2017-2022 (On-going)	2022- (Complete)		
	CCESP project	Hon Ro 2 Resettlement Site	CCSEP	Ngoc Hiep Resettlement Site	CCSEP project	Ngoc Hiep Resettlement Site	CCSEP project	
Water quality	+2	0	-1	0	-1	0	+3	+3
Aquatic system	+1	0	0	0	-1	0	+2	+2
Air pollution	+1	0	-2	-1	-1	0	+1	+1
Traffic, and health safety issues	0	0	-2	-1	+2	0	+2	+2
The quality of people life in subproject area	+2	+2	-2	-1	+1	+2	+2	+2

Note: "+" and "-" respectively stand for positive and negative impacts

"0,1,2,3" indicate the levels of impact, respectively none, low, medium and high

It can be seen from the above assessments that cumulative impacts are mostly beneficial to the environment and society when the subproject is put into operation. After being completed, the stormwater and wastewater drainage systems and the wastewater treatment system in Nha Trang City will be significantly improved, contributing to improving the water quality of Quan Truong river and Cai river, minimizing flooding, and reducing traffic flow along inner-city roads. The potential negative cumulative impacts can be mitigated with coordinated management of the project implementing units in compliance with the applicable environmental and social safeguard policies. In addition, the cumulative impacts could also be mitigated through implementation of the mitigation measures in the ESMP during the subproject implementation and operation.

E. COMPLIANCE WITH ENVIRONMENT AND SAFETY REGULATIONS AT MINES

The demands for construction materials under the Subproject are: over 54,000m^3 of sand, over 20,000m^3 of stones of all types, and over 200,000m^3 of backfilling soil of all types.The main transport route from these mines to the city is via National Highway No. 1A, then 23/10 Street to Nha Trang city. Within a radius of 2km around these mines, the areasare very sparsely populated, so impacts on the community during transportation are negligible. National Highway No. 1A and 23/10 Street are main routes, where traffic is relatively busywith a lot of heavy trucks. The risks of traffic accidents during transportation, therefore, are likely to happen. During transportation of the materials, there may be drop and overspill of soil and stone,generating dust and noise and affecting residents along the roadsides of 23/10 Street and other streets in Nha Trang city if transport vehicles are not well covered and cleaned.

The said licensed material mines have all complied with policies on environmental safety and labor safety, and have carried out procedures of environmental deposit according to the Vietnamese Laws. Compliance assessment of some mines planned for the provision of materials for the Subproject is presented in Appendix 1.

F. CLIMATE CHANGE

Climate change has much affected environmental conditions: in Nha Trang, in the period from 2020-2100 climate change could raise the temperatures by 0.4-1.9^{0}C, precipitation by 0.7-3.2mm and sea water level by 28-33cm. These would result in increased drought in the dry season and flooding in the rainy season. Salinity can intrude further inland. Therefore, it is of paramount importance to implement of plans and programs in response to climate change, ensuring sustainable development in the future.

Investing in the construction of a system of handling environmental pollution (wastewater treatment included), stormwater drainage systems to minimize flooding is also one of the oriented responses to climate change in accordance with the action plan devised for Nha Trang city.Handling pollution sources in the locality also contributes to limiting the sources of infectious diseases likely to spread widely through the water environment in a context of complicated climate change.

The treatment of wastewater pollution also helps limit the emission of gases contributing to climate change, such as CH_4 and CO_2 which can be generated in anaerobic processes of wastewater flow or stagnant wastewater, thereby contributing to reducing the impact of climate change.The construction of embankments on the Northern and Southern banks of Cai river will help limit erosion of the riverbanks, ensuring the safety for people's properties and lives, especially during times of heavy rains, hurricanes and floods in the city.

The designed elevations of the WWTP and the new roads and embankmentswill also have totake into account climate change developments to take place in the future.

G. INDUCED IMPACTS

The proposed subproject is limited to construction and rehabilitation of the drainage and sewer system, construction of a new WWTP, balancing, Stormwater and wastewater pumping station, embankment, and traffic road. The subproject would not involve construction of housing or commercial development areas that would directly affect the number of residents or employees within the area, neither would it directly contribute to the creation of additional housing or jobs in the subproject areas and thus would not result in direct or indirect growth inducement. Given the scale of the subproject interventions, their locations, and planning of the city, it is anticipated that there would be potential induced social impacts of land use changes as a result of the subproject such as increase in land prices, triggering significant land speculation and potential dislocation of poor people leaving along the subproject roads. The new the WWTP would have sufficient capacity to treat future effluent flows.

CHAPTER 4. ANALYSIS OF ALTERNATIVES

The subproject has been prepared in line with: i) General planning of Nha Trang city till 2025 with the orientation of planning is the construction of wastewater and stormwater drainage system, which was approved according to the Decision no.1396/QD-TTg dated September 25, 2012; ii) 1/2000-scale detailed planning of Vinh Hai-Vinh Hoa ward (traffic, drainage, water supply, leveling and land use) according to the Decision no.1391/QD-UBND dated June 17, 2009; and ii) 1/2000-scale detailed planning of Vinh Tho-Vinh Phuoc ward traffic, drainage, water supply, leveling and land use) according to the Decision no.1392/QD-UBND dated June 17, 2009.

During the impact assessment of the subproject, the analysis of alternatives is an important stage in the assessment. The main objective of the analysis of alternatives is to identify location, design, technology applicable for a particular project component in order to minimize adverse impacts and maximize positive impacts. The analysis of alternatives has been conducted for each component of the subproject. The results of analyses are presented below.

4.1. Environmental and Social factors Considered in Formulation of the Feasibility Study

All the below factors were considered and examined in determining the location and preparing the feasibility study for work items to be constructed in Nha Trang city:

- Nha Trang is on its way of strong socio-economic development, entailing risks of environmental pollution which need to be addressed so as to ensure sustainable development. The consolidation of drainage, wastewater treatment and traffic infrastructure will be essential and aimed at creating prerequisites for sustainable economic, social and environmental development.
- With the proposed locations, efforts have been made in limiting the scope of land acquisition and clearance, e.g. the area for the WWTP is vacant land, the acquisition of which will not impact local people's houses and crops. Also, the selection of such items as the main drainage system along Road No.4 and the balancing lake area will reduce the impact from land acquisition and demolition of houses.
- The northern area of the city has no domestic wastewater treatment system, and wastewater is discharged directly into the natural environment, causing pollution. In the southern area of the city, despite the presence of a wastewater collection and treatment system, the incomplete tertiary sewer system does not help promote fully the role of the southern WWTP. Therefore, investments in a sewer system, a wastewater treatment plant and a tertiary sewer network in the southern area of the City are extremely practical.
- The construction site for the proposed WWTP is far away from residential areas (approximately 100-200m to the nearest residential area). Within the construction scope, only 15 households will be affected by acquisition. This is currently vacant land and the plant location has been chosen in accordance with detailed plan of 1/2000 scale to be to the southwest of Hon Nghe mountain in NhaTrang. The treated wastewater receiving point is a water creek adjacent to the construction area for the WWTP. Treated wastewater would then flow into Cai river. The chosen construction site for the WWTP is therefore suitable with the natural and social conditions of the area, thus minimizing site clearance compensation and matching the planning. The treated wastewater receiving source is conveniently located, contributing to saving on the costs of pipeline construction.
- The construction site for the Northern and Southern roads and embankments of Cai river is the final section of the river flowing to the sea. Along the Southern bank there are many restaurants, from which wastewater is discharged into rivers, causing pollution. This area is

also prone to slides during floods, affecting households along Cai riverbank. In addition, road traffic in this area towards the upstream side of the river is very difficult; an alternative is to travel through inner-city narrow roads with high risks of congestion. The beginning point of the route intersecting with 2/4 Street is also an area with heavy traffic and high risk of congestion during peak hours. Therefore, investments in this route are necessary and appropriate in terms of practical needs.

- In the city, inundation still occurs during prolonged heavy rains. With high rise of the water level in Cai river(over 2.65m), it will be difficult for water to be drained from Vinh Hai and Vinh Ngoc into Cai river. Therefore, investments in a rainwater drainage system in the northern area of the city a regulating lake in Vinh Hai, and a stormwater pumping station in Vinh Ngoc will meet practical needs of the localities.

4.2. "With the Subproject" and "Without the Subproject" Alternatives

If the subproject is not implemented, negative problems are bound to exist in current conditions:

- Practical conditions show that in the Northern part of the City, the areas of Bau market and SOS Village are prone to frequent inundation. With no wastewater treatment plant in the Northern catchment, wastewater mostly penetrates down or is discharged into the sea and Cai river. Odor pollution, damaged urban landscape and infectious diseases have greatly affected the living quality of local people. In the future, with increased population, higher living demands and the ever-increasing amount of visitors to NhaTrang, the volume of wastewater will also increase accordingly over time. This means that pollution will be more and more serious and more adversely affect local people.
- At present, many restaurants along Cai river are directly discharging wastewater into the river, polluting the environment.
- Rapid urban development and population growth have entailed the fast rise of demands of water for domestic use year after year. As a result, the volume of wastewater will also increase and exert pressure on the future environment.
- In the catchments to the South of the City, incomplete tertiary sewer systems are incomplete, and thus fail to collect and provide enough wastewater for the effective operation of the Southern WWTP.
- The difficult traffic system is another major obstacle for local people to develop their economy and improve the living quality.
- The toilets in a number of schools have been downgraded, affecting the children learning environment and their health and growth.

Table 4-1 describes in more details the comparison between the "with" and "without" subproject options.

Table 4-1. Analysis "with" or "without" the subproject

Investment items	With the subproject	Without the subproject
Inundation	- The environment of northern area of the city will be improved. - The efficiency of the invested drainage system in the southern part of the city will be promoted.	- Inundation will increase in intensity and frequency, affecting local people's properties and business activities and causing environmental pollution. - The efficiency of the drainage system in the southern area of the

		City invested in the previous stage will not be fully promoted.
Wastewater treatment	- The environment quality in the northern area of the City will be improved. - The capacity and efficiency of the Southern WWTP will be fully promoted. - The wastewater will be treated and meet the standards of QCVN 40:2011/BTNMT), type A.	- The environment quality in the northern area of the City will not be improved, coupled with increased environmental pollution and reduced quality of coastal sea water and Cai river water.
School sanitation	- School children' learning environment will be improved. - The quality of clean water and sanitation at schools will be better, infectious diseases from water and sanitation conditions will be reduced, resulting in a better health outcome for the school children and teachers.	- Poor water and sanitation facilities affecting children's learning, polluting the environment, and hindering their health and development.
Traffic works	- Investment in these work items will facilitate local people's travel, reduce traffic jams, and speed up the development of residential areas.	- There will be great pressure on existing traffic routes.
Embankment works and balancing lake	- Northern and southern roads and embankments of Cai river will help minimize bank erosion and stop riverbed encroachment. - Nice landscapes will be formed in the area along Cai river, attracting visitors. - The balancing lake will help regulate water flow, avoid flooding and create great landscape along road No. 4. It will also improve the water quality in this area.	- The area along Cai riverbank will be polluted by wastewater discharged directly into the river. - Traffic in the area will be difficult. - The existing area of the balancing lake will remain an open place with open sewerage channels with mal odors and environmental pollution and a lot wild trees and weeds, presenting a bad-looking landscape.

4.3. Analysis of Wastewater Treatment Technology Alternatives

There are currently many different domestic wastewater treatment technologies, and the following alternatives have been taken into consideration:

Biofilm Reactor (BFR): This technology makes use of backflow oxidation reactor tanks. Preliminarily treated wastewater and air are simultaneously fed into the tank from bottom up, then treated wastewater will flow out of the tank from the top. In this way, mal odor emission will be reduced.

Sequencing batch reactor (SBR): The SBR is normally divided into 2 areas, a mixing area and a biological reactor area. Nitrification will take place simultaneously with gas supply by stage. The SBR process is well suited to the change of flow and needs simple operation.

Oxidation Ditch (OD): OD technology is a closed cycle, in which the mixed flow in ditches is distributed by baffle walls. Wastewater is continuously discharged from the ditches and directly guided from settling tanks.

Upflow Sludge Anaerobic Blanket (USBA): This technology consistsof following items: trash screens, sand sedimentation tank, balancing tank, USBA reactors, trickling filter system to remove BOD, ammonia, sludge collecting tank, outlet system combined with disinfection, and sludge treatment system.

The detailed analysis of the wastewater treatment technologies are provided in Table 3-1. The analysis indicates that the OD is a good and simple technology with good adaptation to changes in flow and load, and of medium investment costs. Especially, this technology has been successful

applied to the WWTP in Southern NhaTrang, providing much available experience in operation and maintenance. Therefore, the ***Oxidation Ditch alternative (Option 3)*** is selected.

Table 4-2. Analysis of advantages and disadvantages of different technologies

Criteria	Option 1: Bio Film Reactor	Option 2: Sequencing Batch Reactor	Option 3: Oxidation Ditch	Option 4: Upflow Sludge Anaerobic Blanket
Investment cost (USD/m3)*	831.00	937.7	822.93	1,052.4
Operation cost (USD/m3)*	96.782	153.082	144.668	76.435
Construction area	- Lay-out and construction area are small.	- The land area required for the construction of this option is smaller than the two remaining options (Oxidation ditch and USBA tank).	- Require a larger land area for the construction.	- Require a large land area.
Adaptation to change in flow and load	- Very good. - Modular design. - Can adapt to different flow and load conditions.	- Adaptation at average level to different flow and load conditions.	- Adaptation at good level to different flow and load conditions. - Flexible operation.	- Limited adaptation to change in flow, good adaptation to change in load.
Sustainability/easy operation.	- Similar operation and the operation and treatment process is controlled by PCL, however, it is able to operate by manual. - Requires the smallest number of at measuring equipment. - Use less electricity and it does not consume chemicals.	- The least flexible - Dependent on control system, cannot operated manually. - Require information technology skills - Requirements on measuring equipment: average level (altitude and oxygen). - Use more electricity.	- Basically, this process is good. Special attention should be paid to the sedimentation tank. - Requirements on measuring equipment: average level (altitude and oxygen). - Flexible operation and it depends on the circulation of sludge (sedimentation tank). - Use more electricity and it does not use chemicals during operation process.	- Easy to operation in limited space, attention should be paid to the end sedimentation tank, air collecting, storing and power generation require skills. - Use more electricity.

Treatment efficiency	- P can be removed by adding chemicals to the primary reactor, denitrification requires separate removal step. However, this option is hard to meet output regulations according to environmental aspects. Expanding capacity is difficult. - Treatment efficiency of COD, BOD5, SS is high, rangers from 80 to 90% with high treatment capacity. - Volume of generate sludge is low.	- P + N controlled removal process is to be incorporated in the main process. - P + N removal occurs naturally because of anaerobic sedimentation and discharge stage. - Treatment efficiency of COD, BOD5, SS rangers from 80 to 90%. However, the treatment capacity assessed as low because the treatment process is carried out according to shift. - Volume of arising sludge is medium, however, it is necessary to supply a stabilizer for volume of waste sludge.	- P + N removal process is to be incorporated in the main process, system can be upgraded. - Treatment efficiency of COD, BOD5, SS is high and rangers from 85 to 95% with high treatment capacity. - Volume of arising sludge is high with good sludge deposition so it is not necessary to supply a stabilizer for the volume of waste sludge.	- Can not remove N, P, requires secondary treatment stage (anaerobic reactor). - Because the pollution concentration of input wastewater in Nha Trang city is low so the treatment efficiency also is low. - Treatment efficiency of COD, BOD5, SS rangers from 60 to 90% with high treatment capacity. - The process will arise a volume of Methane (0.35Nm^3 methane/kg COD). - Volume of arising sludge assessed as low with good sludge deposition.
Odor control	All the wastewater treatment technologies will cause odor, especially works such as input wastewater collection, sludge treatment. However, the negative impacts caused by odor could be controlled and minimized through the installation of appropriate odor treatment technology.			

CHAPTER 5. ENVIRONMETAL AND SOCIAL MITIGATION MEASURES

5.1. Measures to be Integrated into Subproject Detailed Design

Presented only in this section are mitigation measures related to the components directly invested by the Subproject. In order to create green, safe, environment-friendly, and energy-saving landscapes during the operation of work items, the following solutions have been proposed in the Feasibility Study and will be fully integrated in the detailed design.

(i) Wastewater Treatment Plan (WWTP)

- Designing the plant and the site plan that guarantees a buffer zone distance of 30m from the nearest residential area in conformity with Vietnamese Code QCVN 01:2008/BXD applied to WWTPs without sludge-drying beds and with odor treatment works;
- Arranging the ground scheme of adjusted WWTP after considering impacts from noise and bad odor during construction and operation on schools near the plant;
- Designing the surrounding fences to protect the plant area. As ground leveling has been performed to an elevation of +3.8m, many positions have a ground leveling elevation of about 3m higher than the natural elevation. To prevent storm water from the mountain from affecting the plant fences and overflowing into the plant, an open ditch line of B_m=0.6m has been designed to the mountain side so that stormwater can be drained to the existing ditch outside the WWTP;
- Designing a corridor of green trees surrounding fences to create green landscapes and a grass bed in the plant premises among concrete structures so as to mitigate temperature inversion effects from concrete; planting shade trees around the administrative building (so as to cut down electricity consumption for air conditioners in sunny weather); installing automatic water spray system which uses treated wastewater from the plant;
- Designing the administrative building in a way to make full use of natural light and to use energy-saving water and electricity devices;
- Designing works generating a lot of odors such as intake works, temporary storage facilities and sludge dewatering, etc. in closed houses; designing pipe work collecting gases generated during the treatment process in odor treatment works. (The odor treatment system in the Southern WWTP has been operated effectively with almost no offensive odors perceived in most of the plant premises);
- Using odor control and treatment devices, including a combined system for chemical treatment consisting of reserved flow cleaning vessels installed with chemical feed injector as the initial treatment step, followed by biological treatment in bio-filters using microorganisms;
- Arranging an in-house system of automatic monitoring machine for the parameters of Q, T, EC, pH, COD, SS, and TDS;
- Using anti-corrosion construction materials as the land for the plant construction is a saline area. Depending on technical requirements of work items, sun-dried bricks will be used for suitable items in accordance with Decision No. 567/QD-TTg dated 28 November 2011 by the Prime Minister;
- Arranging adequate safety equipment for the Chlorination House in the WWTP: ventilators, chlorine leakage detectors, flashing alarm lights and sirens, aeration systems, bathrooms with sinks and showers for workers' use after handling chemicals or finishing their shifts;

- The subproject has proposed a ground leveling elevation for the plant premises at +3.8m. At this elevation, the WWTP will not be affected by the flood water level of <3m in Cai river, thus preventing stormwater to overflow into the WWTP;
- Reinstating about 200m of local roads (B = 5m) in Vinh Ngoc ward and other affected infrastructure works during land acquisition for the construction of the WWTP.

(ii) Roads and embankments along Cai river

- The embankments will be constructed in saline water area, so construction materials (cement, etc.) will be those able to resist corrosion from saline water.
- Green trees will be planted along the sidewalks and median strips to create landscapes for the Southern road and embankment of Cai river. Flower beds and lawns shall be planted to create landscapes at the Northern embankment of Cai river.
- The roads will have drainage systems and energy-saving lighting systems ensuring aesthetic beauty; traffic signs will be placed and green tree cells will be arranged along the roads.
- The design of the embankment route 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 location for disposing of salinized sludge will be at a designated site in the new Administrative Urban Center of the province according to a Decision by Khanh Hoa Provincial People's Committee for ground leveling. This area has a salinity level similar to that of the dredged sludge.

(iii) Balancing lake

- Green tree cells will be positioned around the lake between distances of 10 meters. The lakeshore will be protected by both soft and solid structures: stone and macadam structures at the elevation of -1m to +1m and grass cells at the elevation of +1m and above. Surrounding the lake will be lighting systems with steps and handrails for convenient operation and maintenance.

(iv) Roads and sewer lines

- A drainage line is designed across Road No. 4 to mitigate the dike effect that would hinder drainage as the road elevation will be about 4m higher than the existing ground. Stormwater pumping stations are designed to ensure drainage pumping for the area in case the water level in Cai river rises high (over 2.65m).
- In determining the alignment of sewer lines, priority has been given to areas crossing uncultivated land, agricultural land, or public land with few residents, or areas spanning along the existing roads. At intersections with residential areas, a number of adjustments have been made in order to minimize the number people to be displaced.
- Green trees will be positioned at the two sides of the roads between distances of 10 meters.

(v) School toilets

- The school toilets will be designed to ensure aesthetic beauty, friendliness and safety for the pupils, and for children with disabilities and include: i) separate toilets for girls and boys; ii) inside locks; iii) antisloppy floor; iv) enough light; v) separate toilets for children with disability which include safe wheel chair access and wall mounted grab rail. Toilets will have roofs and will be connected to classrooms with cement paths.
- The school sanitation blocks are beautifully designed. The floors will be lined with anti-slip bricks which must also be cleaned easily during use. Power and water devices will be of

energy-saving types. Hand wash sinks will be available. Internal and external walls of the toilets will be decorated with images containing advice on hand washing after using toilets. Trees and flowers are planed around these school sanitation blocks.

- The toilets will be designed to ensure the maximum use of natural light and ventilation. Outlet pipes from septic tanks will be connected directly to wastewater collection pipelines. Sun-dried bricks will be used to the most. No hazardous materials will be used.
- The toilet pans are designed at 20 females/each and 20-30 males/each.

(vi) Pumping stations and sewer lines

- The pump stations located at public places will be so designed to ensure safety and landscape beauty, with fences and warning signs.
- Different alternatives concerning the alignment and scope of the work items have been considered, and priority is given to those alignments which are likely to exert fewer or negligible impacts such as crossing uncultivated land, agricultural land or public land with few residents, or those running along existing roads. At the intersections with residential areas, different options have been considered, and necessary adjustments have been made so as to minimize the number of displaced people. The alternatives of reducing the designed width of roads or intersections have been introduced for analysis and consideration.

5.2. Mitigation Measures during Preparation Phase

5.2.1 Mitigation Measures for Land Acquisition under Component 1 and 2

As presented in Chapter 3, with about 16.6 ha of acquired land of all types, the subproject will cause impacts on 452 households and 5 organizations, including 54 heavily affected households due to the loss of 10-20% of their production land, 69 vulnerable households, 141 resettled households and 20 affected business households, 2 graves and 03 organizations are slightly affected by partial land acquisition. The Community House of Vinh Ngoc hamlet in Vinh Ngoc commune is to be displaced. The gate and the schoolyard of Vinh Ngoc Primary School will be acquired because they are within the buffer zone of the WWTP. The details of policies and measures to be implemented by the subproject to mitigate land acquisition and resettlement impacts are addressed in the Resettlement Action Plan (RAP) of the subproject, the key measures of which are as follows:

(i) Priority will be given to the compensation mode of "land for land" if land is still available in the local land fund and the subproject-affected households (PAH) agree on it. In case land is not available in the local land fund or the PAHs choose to receive compensation in cash instead, they will receive the cash for the affected area of agricultural land and assets on the acquired land, plus100% of replacement costs; in case the remaining land area after acquisition is not sufficient for cultivation, the subproject will compensate for the acquisition of the whole land area.

(ii) In addition to land or cash compensation for the acquired area as stipulated above, the people whose agricultural land is affected are still entitled to enjoy livelihood recovery assistance. Laborers with acquired land participating in vocational training will be entitled to tuition assistance of one course for subjects at the working age, including primary training, intermediate training and vocational college, to free vocational guidance and job introduction at Employment Service Centers, and to loans as stipulated by credit policies towards pupils and students. The subproject will consider giving priority to children of displaced households by employing them as workers during subproject construction.

(iii) During the implementation process, the subproject will pay special attention to women and households whose owners are females with an attempt to create females' equal participation

in the whole process of subproject activities so as to enhance the sustainability of the Subproject.

(iv) All displaced households with legal houses and land shall be entitled to relocated land in resettlement sites. In case households and individuals receive residential land but the amount of compensation and assistance money is less than the value of a minimum resettlement land area, they will be entitled to receive such difference as support. In case they do not choose to receive resettled land in resettlement sites, they will receive money.

Ngoc Hiep and Hon Ro 2 Resettlement Sites invested by the City have been selected to arrange 280 land lots for 141 resettled households. For Hon Ro 2 Resettlement Site, by June 2016, 50% of the volume has been constructed and the entire volume is planned to be completed for putting into use in the 4th Quarter of 2016. 200 land lots are planned to be allocated to the CCSEP. Ngoc Hiep Resettlement Site is planned to be constructed in the 4th Quarter of 2016 and completed for putting into use in the 2nd Quarter of 2018. The estimated total budget for site clearance compensation under the subproject is as follows:

Table 5-1. Total implementation cost of Resettlement Action Plan

No.	Item	Unit	Quantity	Unit price	Amount	
					VND	USD
I. Component 01					**11,426,969,484**	**511,846**
1	Compensation on residential land[10]	m^2	3,893		2,117,064,000	94,829
2	Compensation on agricultural land [11]	m^2	39,269	40,000	1,570,756,000	70,359
3	Compensation on house	m^2	2,725		4,662,613,116	208,852
4	Compensation on architectural structure	m^3	272.5	732,000	199,487,568	8,936
5	Compensation on tree, cropped tree [12]	Tree	3,927		996,928,000	44,655
6	Support for movement	Household	16	4,500,000	72,000,000	3,225
7	Support for house lease	Month. Household	48	2,000,000	96,000,000	4,300
8	Support for life stabilization	Month. Household	14,400	9,817	141,364,800	6,332
9	Support for training, vocation change	m^2	39,269	40,000	1,570,756,000	70,359
II. Component 02					**169,147,850,685**	**7,576,611**
1	Compensation on residential land	m^2	71,677		74,311,222,000	3,328,610
2	Compensation on agricultural land	m^2	22,085	40,000	883,404,000	39,570
3	Compensation on house	m^2	50,174		82,433,209,005	3,692,417
4	Compensation on architectural structure	m^3	5,017	732,000	3,672,729,480	164,512
5	Compensation on tree, cropped tree	Tree	9,956		3,268,642,000	146,412
6	Support for movement of grave	Tomb	2	5,846,000	11,692,000	524
7	Support for movement	Household	125	4,500,000	562,500,000	25,196
8	Support for house lease	Month. Household	375	2,000,000	750,000,000	33,595

[10]The unit price is calculated in detail for each plot
[11]The unit price is calculated in detail for each house
[12]The unit price is calculated in detail for each tree, cropped tree

No.	Item	Unit	Quantity	Unit price	Amount	
					VND	USD
9	Support for life stabilization	Month. Household	112,500	9,817	1,104,412,500	49,470
10	Support for training, vocation change	m^2	22,085	40,000	883,404,000	39,570
11	Vulnerable households	m^2	62,100	9,817	609,635,700	27,307
12	Support to stabilize business		20	28,350,000	567,000,000	25,398
13	Support to move business establishments		20	4,500,000	90,000,000	4,031
III. (I+II)					**180,574,820,169**	**8,088,458**
IV. Management cost = 2%*(I+II)					**3,611,496,403**	**161,769**
Total					**184,186,316,572**	**8,250,227**

The cost estimate for the implementation of the RAP of the subproject is thus **184,186,316,572**VND (corresponding to **8,250,227**USD at the exchange rate of 22,235 VND = 1 USD). This cost estimate excludes training costs as those costs are included in the investment for Component 4 of the subproject.

The subproject will also prepare and perform well the community communication and consultation plan so as to mitigate risks related to social impacts.

5.2.2. Mitigation of UXO risks and impacts from demolition and ground leveling for site plan preparation

With the risk of UXOs left by the war and remaining undestroyed in the construction site, the cost of UXO detection and disposal is estimated to be about 700 million VND. The subproject owner will sign a contract with the military civil engineering agency or Khanh Hoa Provincial Military Base for UXO detection and clearance at the construction site. UXO clearance will be executed right after the completion of site compensation and before the implementation of demolition and ground leveling.

5.2.3 Mitigation Measures for Relocation of Graves

There are two household graves which will need to be relocated for construction of Road No. 2 under Component 2 of the subproject. Compensation for the removal of these graves is included in the RAP of the subproject and will include the cost for buying of land for re-burial, excavation, relocation, reburial and other related costs which are necessary to satisfy customary religious requirements. Compensation in cash will be paid to each affected family or to the affected group as a whole as is determined through a process of consultation with the affected community. The level of compensation will be decided in consultation with the affected families/communities. All costs of excavation, relocation and reburial (5,800,000 VND/grave) will be reimbursed in cash. Graves to be exhumed and relocated in culturally sensitive and appropriate ways. During implementation the Subproject Owner will make early announce to the households whose graves are affected so that they can arrange their embodiment in consistence with the spiritual practices of the people and compensate to the affected household as required in the subproject RAP and ESMP.

5.3. Mitigation Measures during Construction Phase

As identified in Chapter 3, potential impacts and main risks which may occur during construction include: (i) Impacts from dust, exhaust gases, noise, offensive odors and vibration, (ii) Wastewater impacts, (iii) Solid waste, (iv) Hazardous waste, (v) Impacts on terrestrial and aquatic species, (vi) Impacts on urban beauty and landscape, (vii) Water quality, (viii) Flooding, erosion and sedimentation impacts, (ix) Traffic safety issues, (x) Subsidence impacts, (xi) Social impacts, (xii)

Community health and safety, (xii) Safety and health of workers, (xiv) Impacts on infrastructural works and existing services, (xv) Impacts on PCRs, (xvi) Cumulative impacts

5.3.1. Mitigation Measures for General Construction Impacts

The commonly accepted and widely applied Environmental Codes of Practice (ECOPs), which describe typical requirements to be undertaken by contractors and supervised by the construction supervision consultant during construction, will be used for addressing the typical impacts under Component 1 and 2 during construction and are presented below.

i) Mitigation of Impacts from Dust, Emission, Noise, Vibration, and Offensive Odors

- Maintain the level of emission at construction sites within the permissible limit provided for in QCVN 05: 2013/BTNMT: National Technical Regulation on Ambient Air Quality.
- Only use transportation vehicles with valid registry.
- Neatly gather construction materials and wastes. Arrange for the workers to collect and gather construction materials and wastes to the designated places at the end of each day or shift.
- Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25^{o}C, or in windy weather. Avoid overwatering as this may make the surrounding muddy.
- Do not overload the materials/soils and stones to extreme heights onto trucks, as this may result in drops along transportation routes. Tightly cover the trucks carrying wastes and bulk materials before getting out of construction sites or quarries and borrow pits so as to restrict scattering along transportation routes.
- Put temporarily gathered materials and waste heaps with a volume of about 20m^{3}within barriers or covered so as to avoid dust dispersion.
- Transport wastes out of construction sites to the designated locations for reuse or to the disposal sites in the soonest possible time.
- Burning waste will be prohibited at the construction sites.
- Do not put vehicles and machines to run idle in more than 5 minutes.
- Avoid 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 WWTPs, regulation lakes, stormwater pumping stations and main pumping stations.
- Periodically wash the trucks used for transporting materials and construction wastes.
- Avoid construction operations generating great vibration and loud noise within the time between 6pm and 7am when construction takes place near residential areas. Night construction must be informed to the community at least 2 days in advance.
- Perform the method of successive construction for each sewer section in construction sites of long sewer lines.
- Observe and secure construction progress correctly.
- Set up 2.5m-high fences of corrugated iron around the construction sites such as the areas for the WWTP, the balancing lakes, the Southern and Northern embankments and roads of Cai river.

ii) Wastewater management

- Employ local workers to limit the amount of generated domestic wastes and wastewater.
- Provide septic tanks for toilets for treating wastewater before it can be discharged into the environment. On-site mobile toilets with 3-compartment septic tanks can be used in areas for major work items as traffic roads, WWTP, and regulation lakes.
- Wastewater from kitchens and bathrooms at workers' camps must be treated before being discharged to the environment through drainage ditches with sedimentation pits.
- Clear ditches around the workers' camps every week.
- Leave construction wastewater, used water from washing construction tools and vehicles, and stormwater overflowing from construction sites and foundation pits settle in settling ponds before entering water sources.
- Build sedimentation ponds and ditches to receive stormwater runoff at the construction sites such as the areas for WWTP, balancing lakes, stormwater pumping stations, and main pumping stations.

iii) Solid waste management

Normal solid waste

- 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 Luong Hoa landfill.
- 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 Luong Hoa landfill in accordance with design documents acceptable to the supervision engineer.
- Weathered soil, wood and bricks can be reused for useful purposes such as ground leveling. Wood scraps may be used for cooking. Corrugated iron, iron, steel, packing materials and other materials which can be recycled can be delivered and sold to scrap traders.
- Collect waste and tidy up construction sites at the end of a working day/shift and the transport waste out of the construction sites in the soonest possible time. If dredged materials are to be temporarily stored, necessary measures must be applied to control pollution such as gathering them within enclosures, under coverings, within fenced areas, etc. with warning signs.
- The Contractor will sign a contract with Khanh Hoa Urban Environment 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.

Hazardous waste

- 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 (Van Dao Limited Company, Khanh Hoa branch may be employed for this task).

iv) Measures to control water pollution

- The Contractor is responsible for controlling the surface water quality when discharging it out of the construction site, in accordance with QCVN 08-MT:2015/BTNMT – *National Technical Regulation on surface water quality* and QCVN 14:2008/BTNMT – *National Technical Regulation on domestic wastewater quality*.
- Provide preliminary sedimentation ponds and ditches of stormwater runoff at the construction sites such as the areas for WWTPs, balancing lakes, stormwater pumping stations, and main pumping stations.
- 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 balancing lakes and embankments and roads on Cai river.
- 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.

v) Measures to control impacts on terrestrial and aquatic species

- 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.

vi) Measures to control impacts on urban beauty and landscape

- 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 culturalworkssuch aspagodas, churches, temples, etc.
- Regularly collect materials and wastesand tidy up the construction site.

vii) Measures to control sedimentation, erosion and flooding

- Avoid disturbances and damage to the existing vegetation and green trees.
- Periodically and thoroughly removes oils, 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.

viii) Measures to control landslides and subsidence

- Limit disturbances to construction areas, especially in locations currently with green trees or vegetation.
- Do not set up offices, camps, or temporary works on sloping areas.
- Use Larsen sheet piles for building prop walls when excavation is performed to a depth of 2.5m and more.
- Reinforce weak slopes and protect them with sandbags when there are high risks of erosion and landslides or in case of visible gully erosion.

ix) Measures to control the traffic and secure traffic safety

- 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 near schools.
- Install night lighting of all construction sites.

x) Control of impacts on existing services and infrastructure works

- 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.

xi) Social mitigation measures during construction

- Inform the community at least 2 weeks before commencement of the construction. In case electricity and water supplies are to be disrupted, the PMU must inform PAHs of the same at least 2 days in advance.
- Employ local laborers for simple tasks. Instruct workers on environmental issues, safety and health before construction tasks are assigned. It is advisable to communicate to migrant workers on local customs, practices and habits in order to avoid conflicts with local people.
- The subproject owner and contractor are to cooperate closely with the local government in performing effective community sanitation in case of epidemic symptoms breaking out in the area.
- The subproject owner and contractor are to cooperate with local authorities in preventing and fighting against social evils. Conduct sensitization campaigns with both workers and communities on these issues, liaison with local organizations to ensure monitoring, and a grievance redress system to which the community can refer to.
- The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers.
- Workers temporarily residing at the camps and rented houses must be registered with the local authorities for temporary residence.
- Train workers on issues related to social security, social evils, diseases and epidemics, prostitution and drug use, environment, safety and health, HIV/AIDS and infectious diseases within 2 weeks prior to the commencement of packages with construction items lasting at least 6 months.
- Prohibit workers from:
    + Consuming alcoholic drinks during working time
    + Quarreling and fighting
    + Gambling and indulging in social evils such as drug use and prostitution
    + Disposing of garbage indiscriminately

xii) Control of impacts on cultural and religious 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:
    + Suspend construction operations at the place of discovery;
    + Preliminarily describe the area where the archaeological objects are to be unearthed;
    + Strictly protect the area of the discovery so as not to damage or lose moveable objects. In case the unearthed objects are moveable or sensitive ruins, provide night protection until the local authorities, the Department of Culture, Sports and Tourism or the Institute of Archaeology takes over these unearthed objects;
    + Inform the Supervision Engineer of the event and who in turn will immediately inform the subproject owner, the local authorities in charge of the case and the Institute of Archaeology (within 24 hours or less);
    + Local relevant agencies and the Vietnam National Administration of Tourism will be responsible for protecting and preserving such archaeological relics before making decisions on the next suitable formalities. The Institute of Archaeology may be needed in the preliminarily assessment of the unearthed objects. The significance and importance of such discovered objects will be assessed by different criteria related to the nature of cultural heritages; such criteria would include aesthetic, historical, scientific, social or economic values;
    + Decisions on handling such discovered objects will be made by competent levels. Such decisions can result in changes in site arrangements (e.g. when the discovered item is a cultural relic which cannot be displaced or is archaeologically important, it is necessary to preserve, recover and excavate it);
    + The implementation of such decision by competent agencies related to the management of discovered objects will be communicated in writing by local competent agencies; and
- Only resume construction activities at the site after being permitted by the local competent agencies and the PMU in relation to safeguarding such relics.

xiii) Mitigation measures for 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.

xiv) Some Mitigation Measures Implemented under the CCESP

Some images of compliance with the ESMP and good construction management practices during implementation of the Nha Trang subproject under the CCESP are provided in Figure 5-1 below.

<table>
<tr>
<td> 

Bulletin board of the Subproject set up byBach Dang Contractor</td>
<td> 

Fences installed along the majorconstruction routes to ensure traffic safety</td>
<td> 
Sandy bags arranged on talus to prevent drift sand down slope of the main pumping station.</td>
</tr>
<tr>
<td> 
Intake ditch for the overflow stormwater settlementat the construction site of Southern WWTP</td>
<td> 
Workers usingadequate safety gear and safety belt on the construction site of Southern WWTP</td>
<td> 
Larssen sheet piles preventingbank slumping at deep excavation sites</td>
</tr>
</table>

		
Trucks runningalong the construction route to transport excavated materials to the disposal site upon construction on the main streets. The Contractor provides makeshift access into local houses.	*"Sorry for any inconveniences caused" signs placed by a ditch construction site of sewer pipeline near Binh Tan bridge.*	*Ground surface reinstated and tidied up after completed installation of manholes in tertiary network.*

Figure 5-1. A number of images of mitigation measures under CCESP

5.3.2. Specific Mitigation Measures for the SpecificTypes of Works

In addition to general measures mentioned above, the following specific measures will be applied to the construction of each specific work item:

Component 1:

(1) Mitigation Measures for Construction of the Sewers

- 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.
- Develop and implement a plan for successive construction, with each 50m section for the wastewater sewers and 300m for the stormwater sewers.
- Restore the site of each completed construction within 24 hours. In sections to be asphalted, asphalting must not exceed 3 weeks from the date of site restoration. After stormwater drainage lines are installed, carry out backfilling immediately in accordance with the technical design requirements before starting excavation for the next section.
- Put fences, sign boards, warning boards, beacons, and barriers along the ditches and roads under construction in accordance with current regulations. Place the sign boards with writing "Sorry for any conveniences caused" in densely populated areas with many restaurants, hotels, etc.
- Deploy staff to watch for the traffic and give instructions and warnings, especially when vehicles come in and out of the construction sites or stop for loading and unloading of materials and waste.
- Neatly gather materials and wastes, avoiding encroachment on existing roadways, sewers, and drainage manholes. Collect thoroughly the excavated soil falling in existing stormwater manholes and drains.
- Immediately transport the excavated soils to the designated areas outside the construction sites.
- Coordinate with the relevant authorities before the sewers crossing the streets to arrange for traffic channelization if necessary. In case the construction area would take up only 50% of the road width, carry out the construction activities in one half of the pavement, with the other

half reserved for vehicle circulation. Carry out construction of the road-crossing sewers at the times of light traffic as at night, during which lighting must be properly provided.

- Avoid construction activities that may generate loud noise at noon, midnight or in the early morning, in areas near residential areas. If construction is planned to be carried out at night, inform the community at least 2 days in advance.
- Clean the construction sites and tidy up after every construction session.
- Install temporary access to give access to roadside houses and shops, affected by ditch excavation.
- Use wall piles in the excavated pits and ditches with a depth of 2.5m and over. Check the bearing walls and reinforce to ensure the stability of the excavated pits.
- Fence off the excavated pits and ditches to avoid fall of people, especially the children.
- Backfill the excavated ditches and pits and reinstate the pavements in the soonest possible time.
- For tertiary sewers to be located in alleys, provide temporary walkways or ground surfaces, do not gather materials, and do not use large-sized construction vehicles and means in such areas.

(2) Mitigation Measures for Construction of the WWTPs and Balancing Lakes

- 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.
- Put corrugated iron fences with a minimum height of 2m, and with a minimum height of 3 m at the plant corner near the primary school.
- Locate the places for washing vehicles at the entrance to the sites. Channel wastewater from vehicle washing to a settling pond before discharging into the environment.
- Excavate and maintain the ditches and canals which collect and direct stormwater to mud pits before stormwater could overflow from the plant site to the outside.
- Make macadam on the service roads in the plant premises to limit dust and prevent materials from being washed off by stormwater.
- Spray water onto the site within 20 m from the gate of the plant and local roads at least three times a day on dry days.
- Carry tidying up on the routes around the site within a radius of 20m after each construction session (existing Hung Loc Hau street with the treatment plant, access road to the site to the intersection with Nguyen Khuyen street for the construction of the balancing lakes).
- Carefully cover bulk materials and keep in temporary storehouses.
- Restore the road for community travel in the WWTP area upon completion of the construction.

(3) Mitigation Measures for Construction of the Pumping Stations

- 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;
- Put corrugated iron enclosures with a minimum height of 2m around the construction site.

- Fence off the construction sites by iron sheet of 2m high to ensure safety for people.
- Put warning signs of construction site, deep pits, and speed limits on the section passing the construction site.
- Use Larsen sheet piles to prevent wall slumping.
- Gather materials and excavated soils around foundation pits and properly monitored to ensure minimum scope of disturbance.
- Collect wastes and construction materials within 20m around pumping stations every day.
- Provide ladders to the workers for safe operations in deep pits.

(4) Construction of the School Sanitation Blocks

- 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.
- Informed the school boards of directors in advance of the construction plan to cooperate in management of school students, security, and safety during construction.
- Assign security guards around the construction sites so as to warn pupils in due time against approaching the construction site.
- Put fences warding off the site and warning signs; Water the existing sanitation blocks before and during demolition to limit dust.
- If possible, provide separate entrances and exits for waste and material trucks.
- Schedule demolition of the existing toilets beyond study hours. Fence off the construction site with iron sheet of 2m high to limit dust and ensure safety for the school children.
- Avoid activities generating great noise or vibration such as demolition of concrete structures or driving of piles during class hours.
- Collect any wastewater generated by the construction to a setting tanks before discharging to the outside of the school.
- Schedule trucks transporting waste and materials not to enter and exit the school before the start of class hours, during school time, or just after class hours.
- Gather materials and wastes neatly during construction and dispose the wastes at the designated site within the soonest possible time and within less than 24hours.

Component 2

(1) Construction of the Roads

- 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.
- The slops must be reinforced upon construction of Road No.4 to avoid slides, endangering construction operations.
- Tidy up the routes around the construction site within a radius of 40m after each construction day.
- Limit construction activities in Chu Dong Tu Road area at night.

- Cover and shield the traveling transport vehicles carefully.
- Inform the community of the planned night construction at least 2 days in advance.
- Prepare implement the drainage plans for the construction of Road No. 4.
- Put the road construction warning signs at the site all the time.
- Assign staff to guide the traffic during transportation, unloading, and loading.

(2) Construction of the embankments and roads along Cai river

There are several sensitive locations near the construction location of embankment road along Cai river, including Po Nagar Cham Towers (away 40m North embankment road of Cai river), Ngoc Thuy monastic (near South embankment road of Cai river) and material transport route April 2 Street with high traffic density. The site-specific mitigation measures for those locations are presented in the Table 5-2. Below is the site-specific mitigation measures for the works item Cai river embankment.

- 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.
- 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 details on the DMMP are described in the Chapter 6 – Environmental and Social Management Plan.
- Exclude underwater activities from the DMMP for rainy seasons.
- Upon forecasted stormy weather, suspend all the construction activities, tidy up the sites, brace and protect the materials and construction machines.
- Implement protection measures for the sections of the riverbank to be dredged and for road and embankment to be constructed before starting the work.
- Build each section of the road and embankment prior to dredging and construction of the embankments to limit impacts on water quality and aquatic life of Cai river.
- Operate the machines used in dredging at only slow speeds in each specified period of time, with break time for sludge settlement (Luong Hoa landfill).
- Place warning signs at potentially dangerous places with undercurrents, erosion or deep excavation.
- In case of material leakage from the dredged materials, the contractors will have to take all necessary measures to tidy up the areas to prevent the spread of pollution.
- In case construction needs to be executed at night time or early morning, inform the community at least 2 days in advance, and only carry out the activities that will not generate much noise and vibration.
- Provide the workers with and request them to use life jackets in construction operations on the water surface. Observing staff must be present during entire shifts for timely rescue in case of drowning incidents.

- Place warning boards along the construction route, both on land and water surface. (arrange the road and waterway traffic guide).
- The dredged materials will be disposed at the Urban and Administrative Center for ground leveling as the salinity in this area is similar to that in Cai river area. This disposal site for the subproject has been agreed by Khanh Hoa Provincial People's Committee.

Mitigation measures for the disposal sites:

It is planned that excavated and dredged materials from the subproject will be disposed of at the area of the Urban and Administrative Center of the province for ground leveling. The following measures must be applied at this area during disposal under the subproject:

- Place the speed limit signs at the entrance and exit of the disposal site.
- Place the warning signs of "Authorized personnel only", restricting the access of unauthorized people to the disposal site.
- Thoroughly empty truck bodies before getting out of the disposal site to ensure no remaining waste would drop onto the roads.
- Provide a place for washing vehicles at the exit of the disposal site and wash the vehicles before getting out of the disposal site.
- Level and roll the dumped waste heaps must to prevent dust from being dispersed, or swept away by wind and water, soil erosion, and landslides to ensure safety risks.
- Identify and mark off natural drainage routes to avoid being filled with dumped wastes, or damaged or disturbed.

5.3.3. Site-Specific Mitigation Measures during Construction

All the sit-specific mitigation measures for addressing the impacts of land acquisition, UXOs clearance, and relocation of the graves during site preparation and clearance are described in details in Sections 5.2.1, 5.2.2, and 5.2.3. Table 5-2 below presents the site-specific mitigation measures to address the site-specific impacts on sensitive receptors.

Table 5-2. Site-specific mitigation measures for each works item during construction

No	Sensitive receptor	Relation to subproject activity	Specific mitigation measures
Site clearance stage			
1	Community House of Xuan Ngoc hamlet – Vinh Ngoc Ward	- Related to the construction of the northern WWTP (Component 1)	- Conduct meetings with the local community and authorities at least 01 month before demolition of the community house to inform them of and the subproject's compensation policies, impacts, and mitigation measures for land acquisition and demolition. - Pay cash compensation in line with the policies mentioned in the subproject RAP. - Coordinate with the local community and authorities for finding temporary alternative locations for community meetings, events, and socialization until construction of the new Community House is completed. An option could be the Commune People Committee Office meeting or conference rooms.
2	Vinh Ngoc Primary School	- Related to the the construction of the northern WWTP (Component 1)	- Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - If possible, implement the construction activities during the school summer vacation. - Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering. - Teachers to be informed of construction operations to keep pupils off the site during their break time. - Prohibit use of construction methods that cause noise during school learning hours. - Prohibit gathering of construction materials in front of the school. - 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. - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations, especially when school children go to and leave the school around construction area. - Tidy construction materials and stockpiles every working session.

			- Immediately address any issue/problem caused by the construction activities and raised by the school management.
Construction stage			
3	Po Nagar Cham Towers	- Located near construction site of the stormwater and wastewater drainage systems on April 2 Street, and at PS2, PS3, CSO3 in Component 1: 30-100m from the stormwater and wastewater drainage line on April 2 Street; 150m from PS2 and CS03; 80m from PS3. - Related to the construction of roads and embankments on the northern bank of Cai river, and Chu Dong Tu Street in Component 2: 40-70m from Chu Dong Tu street construction site; 60m from construction site northern embankment of Cai	- Inform the Po Nagar Cham Tower management and the community 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. - Prohibit gathering of construction materials in front of Po Nagar Cham Towers. - Prohibit construction of workers camps within 100 m from the PoNagar Cham Towers. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the Po Nagar Cham Tower. - Clean the construction area after each working. - Apply speed limit at 10km/h within 100 m from thePoNagar Cham Towers - Sett up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Reinforce trench walls with steel sheet piles for deep excavation to avoid subsidence. - Cover the incomplete trenches under construction at day's end. - Provide night lighting system with luminously painted fence and night lamp (7 pm to 6 am). - Carry out well worker management and avoid the conflict between workers and locals, visitors. - Immediately address any issue/problem caused by the construction activities and raised by the temple management.

		river under Component 2.	
4	An Ton Church	- Related to the construction of stormater and wastewater drainage system on April 2 Street on Component 1; 10m from the construction site	- Inform the church management and the community 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. - Prohibit gathering of construction materials in front of the church. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the church. - Clean the construction area after each working. - Apply speed limit at 10km/h within 50 m from the church - Sett up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at day's end. - Provide night lighting system with luminously painted fence and night lamp (7pm to 6am) - Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. - Immediately address any issue/problem caused by the construction activities and raised by the church management.
5	Bau market	- Related to the construction of stormater and wastewater drainage system on April 2 Street on Component 1;	- Inform the market management and the community of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02weeksbefore start of the construction. - Prohibit gathering of construction materials at the market. - Ensure a drainage ditch at the site and clean any clogs. - Provide a standby pump in case of localized flooding at the market. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Clean the construction area after each working. - Apply speed limit at 10km/h within 50 m from the market

			- Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at day's end. - Providing night lighting system with luminously painted fence and night lamp. - Manage the worker force to any avoid the conflict with the local people and traders. - Immediately address any issue/problem caused by the construction activities and raised by the market management.
6	Ngoc Thuy Vihara	- Related to the construction of the southern embankment of Cai river of Component 2; 20m from the construction site	- Inform the monastery 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. - Prohibit gathering of construction materials near the monastery. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Clean the construction area after each working. - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at day's end. - Providing night lighting system with luminously painted fence and night lamp. - Avoid construction activity before 7:00 am and after 6:00 pm. - Immediately address any issue/problem caused by the construction activities and raised by the monastery.
7	Ba Lang Parish	- Related to the construction of stormwater and wastewater sewers in Duong Hien Quyen	- Inform the Parish of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02weeksbefore start of the construction. - Prohibit gathering of construction materials near the parish. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site.

		(20m away), Pham Van Dong Street (50m away), pumping stations PS1 (50m) of Component 1.	- Clean the construction area after each working. - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at day's end. - Providing night lighting system with luminously painted fence and night lamp (7pm to 6am). - Immediately address any issue/problem caused by the construction activities and raised by the monastery.
8	Vinh Hoa 2 Primary School	- Related to the construction of school sanitation block (Ngo Van So Street), the construction of stormwater and wastewater sewer line in Ngo Van So Street, pumping station PS4 (20m away) of Component 1	- Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - If possible, implement the construction activities during the school summer vacation. - Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering (fence 2m tall). - Teachers to be informed of construction operations to keep pupils off the site during their break time. - Prohibit use of construction methods that cause noise during school learning hours. - Prohibit gathering of construction materials in front of the school. - 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. - Prohibit construction of workers camps within 2 km from the school.
9	Mai Xuan Thuong Lower Secondary School	- Related to the construction of wastewater drainage system in Mai Xuan Thuong (20m away) of Component 1	- Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations, especially when school children go to and leave the school around construction area. - Tidy construction materials and stockpiles every working session.

10	Sao Bien Pre-School	- Related to the construction of wastewater drainage system in Mai Xuan Thuong (20m away) of Component 1	- Cover the incomplete trenches under construction at day's end. - Providing night lighting system with luminously painted fence and night lamp. - Immediately address any issue/problem caused by the construction activities and raised by the school management.
11	Vinh Hoa 1 Primary School	- Related to the construction school sanitation blocks (Dien Bien Phu Street), the wastewater drainage line on Dien Bien Phu Street (20m away) of Component 1.	
12	Vinh Tho Primary School	- Related to the construction school sanitation block (Ton That Tung Street) of Component 1	
13	Vinh Hai 2 Primary School	- Related to the construction school sanitation block (Nguyen Khuyen Street) of Component 1	
14	Market at Duong Hien	- Related to the construction of	- Inform the market management and the community 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.

	Quyen and Dien Bien Phu intersection	wastewater drainage pipeline on Dien Bien Phu Street and Duong Hien Quyen Street (10-30m away) of Component 1	- Prohibit gathering of construction materials at the market. - Ensure a drainage ditch at the site and clean any clogs. - Provide a standby pump in case of localized flooding at the market. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Clean the construction area after each working. - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at the end of the day. - Apply speed limit at 10km/h within 50 m from the market - 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. - Immediately address any issue/problem caused by the construction activities and raised by the market management.
15	Vinh Ngoc Primary School	- Related to the construction of the WWTP of Component 1 (50-100m away)	- Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - If possible, implement the construction activities during the school summer vacation. - Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering (fence 2.5 m tall). - Teachers to be informed of construction operations to keep pupils off the site during their break time. - Prohibit use of construction methods that cause noise during school learning hours. - Prohibit gathering of construction materials in front of the school. - 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. - Prohibit construction of workers camps within 200m from the school.

			- Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations, especially when school children go to and leave the school around construction area. - Apply speed limit at 10km/h within 100 m from the school - Tidy construction materials and stockpiles every working session. - Immediately address any issue/problem caused by the construction activities and raised by the school management.
16	Power Company	- Related to the construction of Road No. 4 (10m away) of Component 2	- Inform the Power Company 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 fenced and marked with warning signs to prevent unauthorized people from entering. - 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 and near the company and dispose in a designated site. - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Tidy construction materials and stockpiles every working session. - Immediately address any issue/problem caused by the construction activities and raised by the company. - Arrange traffic guide for the vehicles go in/go out the company.
17	Railway	- Related to the construction of the pressure pipeline conducting wastewater to the WWTP passing the railway of Component 1; and the construction of Road No. 4 at least	- Inform the railway management company of the construction activities and their potential impacts such the risks of interference with the railway train schedule and railway traffic safety. - Inform the railway company of the detail construction work schedule at least 01 month before construction starts. - Set up construction and traffic warning signs at the construction site. - Set up barriers around the construction area to separate working area with the railway (fence 2.5 m tall). - Construct the sewer under passing the railway using safe tunneling method. - Deploy a qualified technical staff to supervise construction activities near the railway.

		15m from the railway slope foot of Component 2	- Only execute construction activities when there is no train schedule. - Prohibit scattering of construction material and wastes near and on the railway. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and during transporting materials crossing the railway. - Immediately collect any domestic wastes and construction spoils around and near the railway and dispose in a designated site.
18	Water supplypipeline	- Related to the area in front of the construction site of the WWTP, to be reinstated of Component 1	- Inform the water supply managementcompany of the construction activities and their potential impacts such the risks of breakage other damages to the water supply pipelineat least 01 month before start of the construction. - Set up barriers around the construction area of water supply pipeline. - Use smaller excavation machine and Larsen pile driving method of construction to avoid breaking or disposition the water pipeline. - Deploy a qualified technical staff to supervise construction activities near the pipeline. - In the case of breaking the pipeline, it is necessary to suspend the construction activities and immediately inform the water supply company and the local authority of the incident.
19	April 2 Street	- Related to the construction of stormwater and wastewater drainage lines on April 2 Street of Component 1 - Related to the material transport route for the entire construction items of the subproject	- Informing the community of the construction schedule at least one week before the construction. - Place fences 2m tall and warning signs of construction at site. - 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. - Reinforce trench walls with steel sheet piles for deep excavation to avoid subsidence. - Spray water three times per day to reduce dust during dry days. - Tidy up construction site during and after every working a session. - Safely cover incomplete construction items and the incomplete ditches at the end of the day. - Provide strong wooden planks or concrete slabs across the trench under construction for temporary access to the houses or businesses. - Provide night lighting system and luminously painted fences (7 pm to 6 am). - Reinstall the road surface if occurring the damages during construction.

20	Pham Van Dong Street	- Related to the construction of wastewater drainage line in Duong De-Vinh Hoa area of Component 1 - Related to material transport route for the construction of wastewater pumping station (PS1, PS3, PS4), and combined sewer overflow (CSO4, CSO5, CSO6), wastewater drainage line in Duong De-Vinh Hoa area of Component 1	- Informing the community of the construction schedule at least one week before the construction. - Place fences 2m tall and warning signs of construction at site. - 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. - Reinforce trench walls with steel sheet piles for deep excavation to avoid subsidence. - Spray water three times per day to reduce dust during dry days. - Tidy up construction site during and after every working a session. - Safely cover incomplete construction items and the incomplete ditches at the end of the day. - Provide strong wooden planks or concrete slabs across the trench under construction for temporary access to the houses or businesses. - Provide night lighting system and luminously painted fences (7pm to 6am). - Reinstall the road surface if occurring the damages during construction.
21	Areas along northern and southern banks of Cai river	- Related to the construction of northern and southern embankments of Cai river	- Informing the community of the construction schedule at least one week before the construction. - Meet and coordinate with the local authorities and fishermen to devise the construction plan, avoiding boat launching time, and work with them to find temporary alternative landing and mooring sites. - Place fences 2.5m tall and warning signs of construction at site. - 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. - Prohibit construction during storm weather and flooding period. - Prepare and implement the detailed DMMP. - Spray water three times per day to reduce dust during dry days. - Tidy up construction site during and after every working a session. - Provide night lighting system and luminously painted fences.

			- Reinstall the road surface if occurring the damages during construction. - Safely cover the trucks transporting salinized dredged soils for ground leveling at the Provincial Urban and Administrative Center. - Execute construction section by section; constructing dikes with wood piles; filling earth for construction. - Maintain good worker camps at the site at least 200m from the river which include: dustbins, first aid kit, fire extinguishers, mobile onsite toilets on site, car wash station at least 500m from the river. - Avoiding gathering construction materials 200m within the river bank.
22	Nguyen Khuyen Street	- Related to material transport route for the construction of Balancing lake, PS5, sewer connecting the balancing lake to Nguyen Khuyen, CSO1,CSO2, School sanitation of Vinh Hai Primary school No. 2, WWTP (Component 1), No.4 road (Component 2) - Ending point connecting to the railway	- 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. - Pay attention to railway warning signs while crossing the railway.
23	Nguyen Xien road	- Related to material transport route for the construction of No.4 road - Ending point connecting to the	
24	Hung Loc Hau road	- Related to material transport route for	

		the construction of WWTP, Rainwater pumping station (Component 1)	
25	Dien Bien Phu road	- Related to material transport route for the construction of Wastewater sewer pipeline, School sanitation of Vinh Hoa Primary school No. 1 (Component 1)	
26	Administrative and Urban Center of Khanh Hoa province	- Related to the disposal area for salty soil arising from the dredging of Cai river and the digging soil of WWTP), away 4km to the dredging area. - Transport route (April 2 – Le Hong Phong – PhongChau) has got high traffic density and is the densely populated area.	

5.4. Specific Mitigation Measures during Operation

5.4.1. For Wastewater Treatment Plant (WWTP) and Sewer System

Succesfful operation of the WWTP will depend on a number of factors including: i) selection of appropriate treatment technologies, the quality and quantity of raw wastewater and its variability; available land area for the treatment facility; ii) resources for capital expenditures, operation, maintenance, and repair; and iii) availability of skilled operators, operator training, maintenance personnel, treatment chemicals, and replacement parts.The following sections focus on the mitigation measures to address impacts of the WWTP on the environment during its operation. Institutional arrangement for the management of the WWTP is addressed in the techinical design documentation of the subproject.

(i) Measures to minimize impact on receiving waters

- Since the combined sewers will be used, minimize bypass of the treatment system by providing capacity sufficient to treat peak flows.
- An online monitoring system is to be installed at the WWTP for controlling the wastewater inflow, quality of the influent and effluent at the WWTP.
- The quality of sample effluent from the WWTP must be analyzed once every 3 months.
- Treatment facilities are to be periodically checked and maintained to ensure highest performance of the system.
- Troubleshooting plans must be prepared to respond promptly to incidents in due time (standby generators, standby pumps, discharge incident …) in order not to disrupt the operation of the plant.
- Based on an assessment of risks to human health and the environment, consider re-use of treated effluent, especially in areas with limited raw water supplies. Treated wastewater quality for land application or other uses should be consistent with the relevant public health-based guidance from the World Health Organization (WHO)[13] and applicable national requirements.

(ii) Odor control

Odor and air emission problems during the operation will be controlled with control measures integrated in the design of the WWTP as described in section 5.1 (i).The following measures are required to prevent, minimize, and control air emissions and odors during operation:

- Domestic waste and sludge generated during the operation of the plant will be safely stored in a closed area before being transported away by URENCO to serve the planting of urban green trees or to be dumped at Luong Hoa landfill of the city. This will reduce bad odors generated from sludge.
- Cover emission points (e.g., aeration basins, clarifiers, sludge thickeners, tanks, and channels), and vent emissions to control systems (e.g., compost beds, biofilters, chemical scrubbers, etc.) as needed to reduce odors and otherwise meet applicable national requirements and internationally accepted guidelines.
- The waste (sludge and domestic solid waste) will be contained in standardized containers to minimize dispersion and gases and solid waste into the environment.

[13]WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater (2006).

- There will be plans to periodically test and monitor air concentrations to obtain proper evaluation and control operation processes in a logical manner.

(iii) Sludge

- Sludge will be periodically monitored to identify any possible hazard: The quality of sludge is monitored periodically 3 months per time with heavy metal parameters are analyzed As, Cu, Cd, Pb, Zn according to QCVN03-MT:2015/BTNMT – national technicalregulation on allowable limits of the heavy metals in the soils
- Sludge will be compacted with gravity compactors and dewatered with gravity belt compressors. Dried mud cakes will be stored in a roofed warehouse at the sludge dewatering area. Periodically one time per month, the plant will hire URENCO to transport this sludge amount way to serve the planting of urban green trees or to be dumped at Luong Hoa solid waste landfill of the city.
- Compressed raw waste will be put in 6m^3containers. Full containers will be replaced with empty ones and disposed of at Luong Hoa landfill.
- Land application or other beneficial re-use of the WWTP residuals should be considered but only based on an assessment of risks to human health and the environment. Quality of residuals for land application should be consistent with the relevant public health-based guidance from the World Health Organization (WHO)[14] and applicable national requirements.
- Processing, disposal and re-use of wastewater treatment plant residuals should be consistent with applicable national requirements.
- URENCO will be employed to periodically dredge sludge from sewer systems and transport this sludge for disposal at Luong Hoa landfill. Transportation will be carried out by specialized tank trucks to avoid odor emission and sludge spillage along the route

(iv) Flow regime and flooding

As assessed in Section A.3.2.3.1 (iv),the existing ditch can completely secure the reception of 15,000m^3/day from the WWTP (with a water level rise by about 10cm). To prevent stormwaterfrom overflowing into the plant, protection and drainage solutions have also been integrated in the design as presented in Section 5.1 (i).The subproject proposal has also mentioned the construction of a pumping station to pump stormwater into Cai river when the water level in the plant area rises high.

(v) 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.

(vi) 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.

[14] WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater (2006).

- Once every 2-3 months, the WWTP will have to employ a local tasked with handing hazardous waste to collect, transport and handle such waste.
- Empty chlorine containers are to be returned to manufacturers.

(vii) Worker health and safety at the WWTP, pump stations, and sewer systems

Worker occupational health and safety impacts associated with theoperational phase of the WWTP primarily include the following: i) Accidents and injuries; ii) Chemical exposure; ii) Hazardous Atmosphere; and iii) Exposure to pathogens and vectors.

Accidents and Injuries:

Work at the WWTP is often physically demanding and may involve hazards such as open water, trenches, slippery walkways, working at heights, energized circuits, and heavy equipment. Work at the WWTP may also involve entry into confined spaces, including manholes, sewers, pipelines, storage tanks, wet wells, digesters, and pump stations. Methane generated from anaerobic biodegradation of sewage can lead to fires and explosions.

The following procedures required to prevent, minimize, and control accidents and injuries at water and sanitation facilities:

The following procedures are required to prevent, minimize, and control chemical exposure at the WWTP:

- Install railing around all process tanks and pits.
- Implement a confined spaces entry program that is consistent with applicable national requirements and standards. Valves to process tanks should be locked to prevent accidental flooding during maintenance.
- Use fall protection equipment when working at heights.
- Maintain work areas to minimize slipping and tripping hazards.
- Implement fire and explosion prevention measures in accordance with the national regulation.
- Ventilate enclosed processing areas and ventilate equipment, such as pump stations, prior to maintenance.
- When installing or repairing the sewers and stormwater drainage sewers adjacent to roadways, implement procedures and traffic controls, such as:
    - Establishment of work zones so as to separate workers from traffic and from equipment as much as possible.
    - Reduction of allowed vehicle speeds in work zones.
    - Use of high-visibility safety apparel for workers in the vicinity of traffic.
    - For night work, provision of proper illumination for the work space, while controlling glare so as not to blind workers and passing motorists.
- Locate all underground utilities before digging.

Chemical Exposure and Hazardous Atmospheres:

- The chlorine station must be equipped with chlorine leakage detectors, ventilation facilities, sirens, flashing warning lights, gas masks, compressed oxygen breathing apparatuses, protective clothing, and a system of emergency watering/showering/ eyewash of the chlorination house.

- Implement a training program for operators who work with chlorine regarding safe handling practices and emergency response procedures.
- Provide appropriate personal protective equipment (including, for example, self-contained breathing apparatus) and training on its proper use and maintenance.
- Prepare escape plans from areas where there might be a chlorine or ammonia emission. In case of chlorine leakage in the storage room, detectors will find out leaks and send out sound alarms, visible signals, and alarm signals via the SCADA system to the operation screen in the central control room. The ventilation fans of the chlorine storage room would stop operating, and the chlorine room will be sealed completely (the rails of the shutter doors would normally open to the inside during normal ventilation). The sprinkler system will then be manually started by operators to reduce escaping gas pressure. Heavy chlorine gas will be sucked out by filter suction fans and through filtering devices, where chlorine will be neutralized by a solution of 20%caustic soda (NaOH).
- Install safety showers and eye wash stations near the chlorine equipment and other areas where hazardous chemicals *such* as chlorine and soda (NaOH)are stored or used.
- Use protective goggles, protective clothes and boots, chlorine masks, and personal gas detection equipment while working at the WWTP.
- Monitoring chlorine gas in the air: Before being discharged it into the surrounding if chlorine levels of exceed permissible maximum concentrations with alarm signals from the gas analyzer, the air purification system must be initiated.
- Periodically sample air quality in work areas for hazardous chemicals. If needed to meet applicable occupational health national requirements or internationally accepted standards, install engineering controls to limit worker exposure, for example collection and treatment of off-gases from air stripping;
- Prohibit eating, smoking, and drinking except in designated areas.
- Rotate personnel among the various treatment plant operations to reduce inhalation of air-stripped chemicals, aerosols, and other potentially hazardous materials.

Pathogens and Vectors:

The measures to prevent, minimize, and control exposure to pathogens and vectors include:

- Include in safety training program for workers, safe handling and personal hygiene practices to minimize exposure to pathogens and vectors.
- Use vacuum trucks or tugs for removal of fecal sludge instead of manual methods.
- Provide and require use of suitable personal protective clothing and equipment to prevent contact with wastewater (e.g., rubber gloves, aprons, boots, etc.). Especially provide prompt medical attention and cover any skin trauma such as cuts and abrasions to prevent infection and use protective clothing and goggles to prevent contact with spray and splashes.
- Provide areas for workers to shower and change clothes before leaving work and provide laundry service for work clothes. This practice also helps to minimize chemical and radionuclide exposure;
- Encourage workers at wastewater facilities to wash hands frequently.
- Provide worker immunization (e.g. for Hepatitis B and tetanus) and health monitoring, including regular physical examinations.

- Reduce aerosol formation and distribution, for example by:
    - Planting trees around the aeration basin to shield the area from wind and to capture the droplets andparticles.
    - Using diffused aeration rather than mechanical aeration and using finer bubbles for aeration.
    - Reducing aeration rate, if possible.
    - Use of floating covers on the mixed liquor of the aeration basin.
    - Suppression of droplets just above the surface, (e.g.by installing a screen or mesh above the basin).
    - Collection of droplets (e.g. by sedimentation, scrubber, electrostatic precipitator, or fabric filter).
    - Disinfection of airborne particles (e.g., by using ultraviolet lights).
    - Use of submerged effluent collector (such as pipes with orifices) rather than weirs.
- Avoid handling screenings by hand to prevent needle stick injuries.
- Maintain good housekeeping in sewage processing and storage areas.
- Advise individuals with asthma, diabetes, or suppressed immune systems not to work at wastewater treatment facilities, especially composting facilities, facility because of their greater risk of infection.

(viii) Leaks and Overflows

Leaks and overflows from the sewerage system can cause contamination of soil, groundwater, and surface water. Overflows occur when the collection system can not manage the volume of wastewater, for example due to high flows during rain events or as the result of power loss, equipment malfunctions, or blockages.

Recommended measures to prevent, minimize, and control leaks and overflows include:

- Consider the installation of separate sewer systems for domestic wastewater and storm water runoff in the overall planning and design of new sewerage systems.
- When on-site sanitation systems where excreta are mixed with water predominate, consider use of small-diameter sewerage system to collect water effluent from septic systems or interceptor tanks.
- Limit the sewer depth where possible (e.g., by avoiding routes under streets with heavy traffic). For shallower sewers, small inspection chambers can be used in lieu of manholes.
- Use appropriate locally available materials for sewer construction. Spun concrete pipes can be appropriate in some circumstances but can suffer corrosion from hydrogen sulfide if there are blockages and/or insufficient slope.
- Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation.
- Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replace if broken to minimize entry of garbage and silt into the system.
- Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas.

- Establish routine maintenance program, including:
    - Development of an inventory of system components, with information including age, construction materials, drainage areas served, elevations, etc.
    - Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. Cleaning activities may require removal of tree roots and other identified obstructions.
    - Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration.
    - Monitoring of sewer flow to identify potential inflows and outflows.
- Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);
- Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
- When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

(ix) Incidental discharge from the WWTP:

- Prepare an emergency plan for incidental discharge of untreated waste water and conduct emergency training for the operators.
- Inform the residents of the incident and mitigation measures.

The WWTP system includes the components of biological treatment tank, flocculation tank, biological aeration tank, and bio-filters which will be designed with the two modules running in parallel to remedy any incident when it happens, specifically:

- In case incidents due to breakage, damage, or leakage:
- Normally, a problem – if any - happens in only one module, the WWTP Company will operate the remaining module while repairing the malfunctioning one. If fixing the incident takes too much time, exceeding the storage time of work items in the system, the Company will suspend operation to solve the said incident problem.
- In case of incidents with devices (wastewater pumps, air blowers, ...):
- All the devices in the WWTP system are equipped with one backup device. Thus, if case of errors occurring with a device, the Company will make use of the standby device and have the faulty one repaired.
- In case of incidents caused by operation:

- When a problem occurs, the technical division and the operating worker will have to review all operational parameters and make adjustments in conformity with the design.
- In case of serious incidents, e.g. the system is unable to work and the treated wastewater fails to meet the standards of discharging treated water and pollutes the environment for a long time, the Company will report this incident to the management agency, i.e. Khanh Hoa Department of Natural Resources and Environment, and suspend production to fix the problem. The Company will employ an expert on wastewater treatment to make inspection and adjustments to the system.
- Corrective measures are to be promptly carried out for the treatment plant to be operated again in the soonest possible time.
- Standby generators must be always available.

5.4.2. For School Sanitation Blocks

- Arranging workers to regularly clean school toilets.
- The schools provide training and awareness raising campaign in school clean water and sanitation for the school children including using hygienic drinking water, washing hand with soap, and school and environmental sanitation.

Table 5-3. A number of images of completed works under CCESP

<table>
<tr>
<td> 
Constructed Da Tuong pumping station under the Subproject helps embellishing the landscape.</td>
<td> 
Constructed school sanitation block</td>
</tr>
<tr>
<td> 
Green landscape inside the Southern WWTP</td>
<td> 
Odors from intake works and receiving tanks for septic tank sludge are effectively monitored as all the works are closed and have pipes to collect and direct emission gases to the treatment unit.</td>
<td> 
Sludge is stored in a closed house (left). Odors generated from treatment units are collected and gathered to the odor treatment unit (right, with external pipes). There is no bad odor within the plant premises.</td>
</tr>
</table>

5.5. Measures to Mitigate Cumulative Impacts

The environmental impact assessment in Chapter 3 concludes that most of the cumulative impacts of the subproject are positive. The negative impacts can be managed through implementation at the subproject and project level. The CCSEP operations would not affect the operation of the southern WWTP. In the cumulative impacts of the construction of Ngoc Hiep Resettlement Site are mainly caused by exhaust gases, dust, solid waste, wastewater, traffic safety risks, and work safety. On the part of the subproject, in order to limit these impacts, mitigation measures outlined in Sections 5.3.1 (i), 5.3.1 (ii), 5.3.1 (iii), 5.3.1 (iv), 5.3.1 (ix), 5.3.1 (xi) have to be effectively carried out. The completion of the construction of technical infrastructure of Ngoc Hiep Resettlement Site and full implementation of environmental impact mitigation measures as presented in the ESIA of the subproject will help successfully limit the cumulative impacts.

CHAPTER 6. ENVIRONMENTALAND SOCIAL MANAGEMENT PLAN

On the basis of the assessment of negative impacts presented in Chapter 3 and the measures of impact mitigation recommended in Chapter 5, this Chapter will present the Environmental and Social Management Plan (ESMP) for Nha Trang Sub-project. The Environmental Management Program will identify the activities/actions to be implemented in the city of Nha Trang Sub-project, including the environmental monitoring program and its implementation schedule, taking into account the compliance with the provisions of the Government's ESIA and safety policies of the World Bank (WB).

To ensure that all sources of pollution arising from the subproject activities during the preparation stage and the construction stage as well as in the operation period will not cause any negative impacts on the environment and public health, it is compulsory that the management, monitoring and supervision of environmental quality be executed in a scientific, systematic and regular manner. Below is a summary of environmental impacts, 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 works items.

(1) All of the potential negative impacts on physical, biological, and social environment could be mitigated through a set of general measures that are typically applied to most of construction projects to minimize impacts such as noise, dust, vibration, waste generation, traffic hindrance, public safety, etc. In this context, an ECOP has been prepared describing specific requirements to be carried out by contractor to mitigate the subproject potential impacts considered to be general impacts (Section 6-1). The contractor will also be required to mitigate site-specific impacts which will be identified to address issues specific to the subproject.

(2) In addtion to adopting the ECOPS, specific mitigation measures have been identified (Section 6-2) for addressing the impacts associated with the specific types of works under the subproject such as the WWTP, sewers, drainage systems. These measures will be included in the contracts for corresponding packages.

(3) All the impacts specific for each sensitive receptor of which mitigation measures could not be addressed through implementation of the ECOPs, site-specific mitigation measures will need to be implemented (Section 6-4).

Measures to mitigate impacts from land acquisition and resettlement are mentioned separately in the Resettlement Plan (RP) and those measures will be carried out and supervised separately.

6.1. Mitigation Measures for General Construction Impacts

Typical common impacts which will be minimized by mitigation measures defined in ECOPinclude: (1) Dust, exhaust gases, noise and vibration; (2) wastewater management; (3) Solid waste management; (4) Hazardous waste; (5) Water pollution management; (6) Impacts on aquatic species and terrestrial ecology; (7) Management of impacts on urban landscape and beauty; (8) Management measures of sedimentation, erosion and flooding; (9) Traffic safety management; (10) Influence to existing infrastructure and services,(11) Management of impacts on social activities; (12) Management of impacts on cultural and religious works; (13) Measures to secure community healthand safety; (14) Measures to secure worker's health and safety, (15)Management of warehouses and borrow pits, (16) Communication to local community.

Table 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, emission, noise, vibration	• Maintain the level of emission at construction sites within the permissible limit provided for in QCVN 05: 2013/BTNMT: National Technical Regulation on Ambient Air Quality. • Vehicles in Vietnam must undergo a regular emissions check and obtain certification: "Certificate of conformity from inspection of quality, technical safety and environmental protection" following Decision No. 35/2005/QD-BGTVT • Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25^{o}C, or in windy weather. Avoid overwatering as this may make the surrounding muddy. • Exposed soil and material stockpiles shall be protected against wind erosion and the location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors. • Dust masks should be used by workers where dust levels are excessive • There should be no burning of waste or construction materials on site. • Cement processing plants should be far from residential areas. • Only use transportation vehicles with valid registry. • Neatly gather construction materials and wastes. Arrange for the workers to collect and gather construction materials and wastes to the designated places at the end of each day or shift. • Do not overload the materials/soils and stones to extreme heights onto trucks, as this may result in drops along transportation routes. Tightly cover the trucks carrying wastes and bulk materials before getting out of construction sites or quarries and borrow pits so as to restrict scattering along transportation routes. • Put temporarily gathered materials and waste heaps with a volume of about 20m^{3}within barriers or covered so as to avoid dust dispersion. • Transport wastes out of construction sites to the designated locations for reuse or to the disposal sites in the soonest possible time.	• 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
	• 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 WWTPs, regulation lakes, stormwater pumping stations and main pumping stations. • Periodically wash the trucks used for transporting materials and construction wastes. • Avoid construction operations generating great vibration and loud noise within the time between 6pm and 7am when construction takes place near residential areas. Night construction must be informed to the community at least 2 days in advance. • Perform the method of successive construction for each sewer section in construction sites of long sewer lines. • Observe and secure construction progress correctly. • Set up 2.5m-high fences of corrugated iron around the construction sites such as the areas for the WWTP, the balancing lakes, the Southern and Northern embankments and roads of Cai river. • When needed, measures to reduce noise to acceptable levels must be implemented and could include silencers, mufflers, acoustically dampened panels or placement of noisy machines in acoustically protected areas • Avoiding or minimizing transportation through community areas and avoiding as well as material processing areas (such as cement mixing)			
2. Wastewater management	• The Contractor must be responsible for compliance with Vietnamese legislation relevant to wastewater discharges into watercourses. • Employ local workers to limit the amount of generated domestic wastes and wastewater. • Provide septic tanks for toilets for treating wastewater before it can be discharged into the environment. On-site mobile toilets with 3-compartment septic tanks can be used in areas for major work items as traffic roads, WWTP,	• QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater;	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	and regulation lakes. 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 WWTP, balancing lakes, stormwater pumping stations, and main pumping stations. • Make appropriate arrangements for collecting, diverting or intercepting wastewater from households to ensure minimal discharge or local clogging and flooding. • Before construction, all necessary wastewater disposal permits/licenses and/or wastewater disposal contracts have been obtained. • At completion of construction works, wastewater collection tanks and septic tanks shall be safely disposed or effectively sealed off.	• QCVN 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 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	• Decision No, 59/2007/NĐ-CP on garbage management; • Decision No,38/2015/NĐ-CP dated 24/04/2015 on waste and scrap management	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	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 Luong Hoa landfill. • 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 Luong Hoa landfill in accordance with design documents acceptable to the supervision engineer. • Weathered soil, wood and bricks can be reused for useful purposes such as ground leveling. Wood scraps may be used for cooking. Corrugated iron, iron, steel, packing materials and other materials which can be recycled can be delivered and sold to scrap traders. • Collect waste and tidy up construction sites at the end of a working day/shift and the transport waste out of the construction sites in the soonest possible time. If dredged materials are to be temporarily stored, necessary measures must be applied to control pollution such as gathering them within enclosures, under coverings, within fenced areas, etc. with warning signs. • The Contractor will sign a contract with Khanh Hoa Urban Environment 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.	• Circular No. 36/2015/TT-BTNMT on	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	• 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 (Van Dao Limited Company, Khanh Hoa branch may be employed for this task) • Chemical waste of any kind shall be disposed of at an approved appropriate landfill site and in accordance with local legislative requirements. The Contractor shall obtain needed disposal certificates. • The removal of asbestos-containing materials or other toxic substances shall be performed and disposed of by specially trained and certified workers. • Used oil and grease shall be removed from site and sold to an approved used oil recycling company. • Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and removed from site by a specialized oil recycling company for disposal at an approved hazardous waste site. • Used oil or oil-contaminated materials that could potentially contain PCBs shall be securely stored to avoid any leakage or affecting workers. • Unused or rejected tar or bituminous products shall be returned to the supplier's production plant. • Relevant agencies shall be promptly informed of any accidental spill or incident • Store chemicals appropriately and with appropriate labeling • Appropriate communication and training programs should be put in place to prepare workers to recognize and respond to workplace chemical hazards • Prepare and initiate a remedial action following any spill or incident. In this case, the contractor shall provide a report explaining the reasons for the spill or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions	hazardous waste management; • Decision No.38/2015/NĐ-CP dated 24/04/2015 on waste and scrap management		

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
5. Water pollution	• The Contractor is responsible for controlling the surface water quality when discharging it out of the construction site, in accordance with QCVN 08-MT:2015/BTNMT – *National Technical Regulation on surface water quality* and QCVN 14:2008/BTNMT – *National Technical Regulation on domestic wastewater quality*. • Provide preliminary sedimentation ponds and ditches of stormwater runoff at the construction sites such as the areas for WWTPs, balancing lakes, stormwater pumping stations, and main pumping stations. • 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 balancing lakes and embankments and roads on Cai river. • Store used and unused oil and petrol in closed containers on impermeable ground covered with roofs and contained within surrounding banks for easy control and collection in case of leakage. Do not locate oil and petrol storages within 25m from ponds, lakes, rivers, and streams. • Collect and transport excavated soils from the construction of sewers and ditches out of the construction site within 24 hours. • Only perform maintenance work of motored vehicles and equipment, including oil replacement or lubrication in designated areas, without allowing chemicals, petrol, oil, or grease to leak onto soil or into the drainage system or water sources. Trays are to be used to hold rags and materials used in maintenance. Collect and discard wastes in accordance with hazardous waste management regulation	• QCVN 09-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: General requirements for concentrated wastewater treatment plants	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
6. Impacts on plants and aquatic species	• The Contractor shall prepare a Clearance, 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 as storage and stockpiling, etc; the stripped topsoil shall be stockpiled in areas agreed to by the Construction Supervision Consultant for later use in re-vegetation and shall be adequately protected. • Trees cannot be cut down unless explicitly authorized in the vegetation clearing plan. • When needed, temporary protective fencing will be erected to efficiently protect the preserved trees before commencement of any works within the site. • No area of potential importance as an ecological resource should be disturbed unless there is prior authorization from CSC, who should consult with PMU, IEMC and the relevant local authorities. This could include areas of breeding or feeding for birds or animals, fish spawning areas, or any area that is protected as a green space. • The Contractor shall ensure that no hunting, trapping, shooting, poisoning of fauna takes place.	• Law on environmental protection No. 55/2014/QH13	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
7. Impacts on urban landscape and beauty	• Carefully cover transport vehicles for materials and waste and periodically wash and clean the vehicles. • Dismantle the camps as well as other temporary works set up during construction and restore the site before the completed work could be handed over to the subproject owner. Back fill and tightly seal toilet pits, septic tanks, and temporary sewerage ditches. • Do not temporarily gather construction materials and wastes within 20m from the gate of schools, offices temples, pagodas, etc. • The Contractor will have to work out construction plans in such a way as to avoid the 1st and 15th days of each lunar month if construction is to be carried out near historical and cultural works such as pagodas, churches, temples, etc. • Regularly collect materials and wastes and tidy up the construction site**.**	• Law on environmental protection No. 55/2014/QH13 • TCVN 4447:1987: Construction regulation • Circular No. 22/2010/TT-BXD on requirements on safety	Contractor	PMU, CSC, IEMC
8. Sedimentation, erosion, flooding, subsidence and slides	• Avoid disturbances and damage to the existing vegetation and green trees. • Periodically and thoroughly remove soils, stones and wastes from drainage sewers and ditches inside and around the construction site. • Neatly gather materials and wastes so as to limit them being swept away by stormwater. • Carry out ground leveling and rolling after discarding materials at disposal sites.	• TCVN 4447:1987: Construction regulation • Circular No. 22/2010/TT-BXD: Regulation on construction safety • QCVN 08:2008/BTNMT – National technical regulation on surface water quality	Contractor	PMU, CSC, IEMC
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	• Law on communication and transport No. 23/2008/QH12; • Law on construction No. 50/2014/QH13;	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	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 near schools. • Install night lighting of all construction sites. • Significant increases in number of vehicle trips must be covered in a construction plan previously approved. Routing, especially of heavy vehicles, needs to take into account sensitive sites such as schools, hospitals, and markets. • Installation of lighting at night must be done, if necessary, to ensure safe traffic circulation. • Employ safe traffic control measures, including road/rivers/canal signs and flag persons to warn of dangerous conditions. • Avoid material transportation for construction during rush hours. • Passageways for pedestrians and vehicles within and outside construction areas should be segregated and provide for easy, safe, and appropriate access. Signposts shall be installed appropriately in both water-ways and roads where necessary	• Law 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		
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.	• Decree No. 73/2010/ND-CP on administrative penalization of	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	• During the construction under power lines, deploy qualified staff to observe and give instructions to the drivers of cranes and excavators so as to avoid causing damages to power lines, telecommunications lines, etc. • Stop construction when existing works are damaged. Identify causes of related incidents and work out solutions. In case the damages are due to the Contractors' faults, the Contractors have to repair, recover, and compensate for all damages at their own expenses. The results of handling such damages must be approved by the Supervisor Engineer. • Reinstall the road surface and sidewalks at construction sites after the construction of sewer lines has been completed. • The contractor should ensure alternative water supply to affected residents in the event of disruptions lasting more than one day. • Any damages to existing cable utility systems shall be reported to the authorities and repaired as soon as possible.	violations related to security and social affairs		
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.	• 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	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	• The subproject will cooperate with the local health agency in developing and implementing plans for control of diseases among workers. • Workers temporarily residing at the camps and rented houses must be registered with the local authorities for temporary residence. • Train workers on issues related to social security, social evils, diseases and epidemics, prostitution and drug use, environment, safety and health, HIV/AIDS and infectious diseases within 2 weeks prior to the commencement of packages with construction items lasting at least 6 months. • Prohibit workers from: + Consuming alcoholic drinks during working time + Quarreling and fighting + Gambling and indulging in social evils such as drug use and prostitution + Disposing of garbage indiscriminately.	on construction safety • Decision No. 96/2008/QD-TTg on clearance of UXOs		
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	• 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
	Culture, Sports and Tourism or the Institute of Archaeology takes over these unearthed objects; + Inform the Supervision Engineer of the event and who in turn will immediately inform the subproject owner, the local authorities in charge of the case and the Institute of Archaeology (within 24 hours or less); + Local relevant agencies and the Vietnam National Administration of Tourism will be responsible for protecting and preserving such archaeological relics before making decisions on the next suitable formalities. The Institute of Archaeology may be needed in the preliminarily assessment of the unearthed objects. The significance and importance of such discovered objects will be assessed by different criteria related to the nature of cultural heritages; such criteria would include aesthetic, historical, scientific, social or economic values; + Decisions on handling such discovered objects will be made by competent levels. Such decisions can result in changes in site arrangements (e.g. when the discovered item is a cultural relic which cannot be displaced or is archaeologically important, it is necessary to preserve, recover and excavate it); + The implementation of such decision by competent agencies related to the management of discovered objects will be communicated in writing by local competent agencies; and + Only resume construction activities at the site after being permitted by the local competent agencies and the PMU in relation to safeguarding such relics			
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.		Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	• The use of new sites for stockpiling, gathering or exploiting materials necessary for construction operations must obtain prior approval from the Construction Engineer. • In case landowners are affected by the use of their areas for stockpiling, gathering or exploiting materials, such landowners must be included in the project resettlement plan. • If access roads are needed for these new sites, they must be considered in the environmental assessment report.			
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.	• 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
	• 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 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.	• Decree No. 73/2010/ND-CP on administrative penalization of violations against security and social affairs	Contractor	PMU, CSC, IEMC

Environmental – social issues	Mitigation measures	Vietnamese regulation	Responsibility	To be supervised by
	• 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.			

6.2. Specific Mitigation Measures for the Specific Types of Works

These specific measures should be used in conjunction with relevant government technical regulations and the ECOPs of the subproject to address the specific types of civil works including construction of the wastewater sewers, wastewater treatment plants, pumping stations, embankment, and roads.

Table 6-2. Specific Mitigation Measures for the Specific Types of Works

Environmental –social issues	Mitigation measures	Responsibility	To be supervised by
Component 1			
1. Sewer lines			
Dust, noise, exhaust gases, vibration and excavated soil	• 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. • Develop and implement a plan for successive construction, with each 50m section for the wastewater sewers and 300m for the stormwater sewers. • Restore the site of each completed construction within 24 hours. In sections to be asphalted, asphalting must not exceed 3 weeks from the date of site restoration. After stormwater drainage lines are installed, carry out backfilling immediately in accordance with the technical design requirements before starting excavation for the next section.	Contractor	PMU, CSC, IEMC

Environmental –social issues	Mitigation measures	Responsibility	To be supervised by
	• Put fences, sign boards, warning boards, beacons, and barriers along the ditches and roads under construction in accordance with current regulations. Place the sign boards with writing "Sorry for any conveniences caused" in densely populated areas with many restaurants, hotels, etc. • Deploy staff to watch for the traffic and give instructions and warnings, especially when vehicles come in and out of the construction sites or stop for loading and unloading of materials and waste. • Neatly gather materials and wastes, avoiding encroachment on existing roadways, sewers, and drainage manholes. Collect thoroughly the excavated soil falling in existing stormwater manholes and drains. • Immediately transport the excavated soils to the designated areas outside the construction sites. • Coordinate with the relevant authorities before the sewers crossing the streets to arrange for traffic channelization if necessary. In case the construction area would take up only 50% of the road width, carry out the construction activities in one half of the pavement, with the other half reserved for vehicle circulation. Carry out construction of the road-crossing sewers at the times of light traffic as at night, during which lighting must be properly provided. • Avoid construction activities that may generate loud noise at noon, midnight or in the early morning, in areas near residential areas. If construction is planned to be carried out at night, inform the community at least 2 days in advance. • Clean the construction sites and tidy up after every construction session. • Install temporary access to give access to roadside houses and shops, affected by ditch excavation. • Use wall piles in the excavated pits and ditches with a depth of 2.5m and over. Check the bearing walls and reinforce to ensure the stability of the excavated pits. • Fence off the excavated pits and ditches to avoid fall of people, especially the children. • Backfill the excavated ditches and pits and reinstate the pavements in the soonest possible time. • For tertiary sewers to be located in alleys, provide temporary walkways or ground surfaces, do not gather materials, and do not use large-sized construction vehicles and means in such areas.		
2. Wastewater treatment plant, balancing lake, rainwater pumping station			
Exhaust gases, dust, noise, vibration, traffic, excavated soil,	• 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. • Put corrugated iron fences with a minimum height of 2m, and with a minimum height of 3 m at the plant corner near the primary school.	Contractor	PMU, CSC, IEMC

Environmental –social issues	Mitigation measures	Responsibility	To be supervised by
solid waste, wastewater	• Locate the places for washing vehicles at the entrance to the sites. Channel wastewater from vehicle washing to a settling pond before discharging into the environment. • Excavate and maintain the ditches and canals which collect and direct stormwater to mud pits before stormwater could overflow from the plant site to the outside. • Make macadam on the service roads in the plant premises to limit dust and prevent materials from being washed off by stormwater. • Spray wateronto the site within 20 m from the gate of the plant and local roads at least three times a day on dry days. • Carry tidying up on the routes around the site within a radius of 20m after each construction session (existing Hung LocHau street with the treatment plant, access road to the site to the intersection with Nguyen Khuyen street for the construction of the balancing lakes). • Carefully cover bulk materials and keep in temporary storehouses. • Restore the road for community travel in the WWTP area upon completion of the construction.		
3. Wastewater pumping station			
Subsidence, dust, noise, vibration, labor safety	• 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; • Put corrugated iron enclosures with a minimum height of 2m around the construction site. • Fence off the construction sites by iron sheet of 2m high to ensure safety for people. • Put warning signs of construction site, deep pits, and speed limits on the section passing the construction site. • Use Larsen sheet piles to prevent wall slumping. • Gather materials and excavated soils around foundation pits and properly monitored to ensure minimum scope of disturbance. • Collect wastes and construction materials within 20m around pumping stations every day. • Provide ladders to the workers for safe operations in deep pits.	Contractor	PMU, CSC, IEMC
Component 2			
1. Northern and Southern embankment and road along Cai river			
Dredged mud, labor safety,	• 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.	Contractor	PMU, CSC, IEMC

Environmental –social issues	Mitigation measures	Responsibility	To be supervised by
dust, exhaust gases, vibration	• 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. • Exclude underwater activities from the DMMP for rainy seasons. • Upon forecasted stormy weather, suspend all the construction activities, tidy up the sites, brace and protect the materials and construction machines. • Implement protection measures for the sections of the riverbank to be dredged and for road and embankment to be constructed before starting the work. • Build each section of the road and embankment prior to dredging and construction of the embankments to limit impacts on water quality and aquatic life of Cai river. • Operate the machines used in dredging at only slow speeds in each specified period of time, with break time for sludge settlement (Luong Hoa landfill). • Place warning signs at potentially dangerous places with undercurrents, erosion or deep excavation. • In case of material leakage from the dredged materials, the contractors will have to take all necessary measures to tidy up the areas to prevent the spread of pollution. • In case construction needs to be executed at night time or early morning, inform the community at least 2 days in advance, and only carry out the activities that will not generate much noise and vibration. • Provide the workers with and request them to use life jackets in construction operations on the water surface. Observing staff must be present during entire shifts for timely rescue in case of drowning incidents. • Place warning boards along the construction route, both on land and water surface. (arrange the road and waterway traffic guide). • The dredged materials will be disposed at the Urban and Administrative Center for ground leveling as the salinity in this area is similar to that in Cai river area. This disposal site for the subproject has been agreed by Khanh Hoa Provincial People's Committee.		
2. Traffic roads			
	• 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.	Contractor	PMU, CSC, IEMC

Environmental –social issues	Mitigation measures	Responsibility	To be supervised by
	• The slops must be reinforced upon construction of Road No.4 to avoid slides, endangering construction operations. • Tidy up the routes around the construction site within a radius of 40m after each construction day. • Limit construction activities in Chu Dong Tu Road area at night. • Cover and shield the traveling transport vehicles carefully. • Inform the community of the planned night construction at least 2 days in advance. • Prepare implement the drainage plans for the construction of Road No. 4. • Put the road construction warning signs at the site all the time. • Assign staff to guide the traffic during transportation, unloading, and loading.		

The details on the DMMP (Northern and Southern embankment and road along Cai 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 5.
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6.3. Site-specific Impacts and Mitigation Measures

Table 6-3. Site-specific mitigation measures

No	Sensitive receptor	Site-specific impacts	Specific mitigation measures	Responsibility	To be supervised by
Site clearance stage					
1	Commune House of Xuan Ngoc hamlet – Vinh Ngoc Ward Related to the construction of the northern WWTP (Component 1)	- Acquisition of land area including the entire Community House - Loss of a common place for community meetings, events, and socialization	- Conduct meetings with the local community and authorities at least 01 month before demolition of the community house to inform them of the subproject's compensation policies, impacts, and mitigation measures for land acquisition and demolition. - Pay cash compensation in line with the policies mentioned in the subproject RAP. - Coordinate with the local community and authorities for finding temporary alternative locations for community meetings, events, and socialization until construction of the new Community House is completed. An option could be the Commune People Committee Office meeting or conference rooms	- Compensation, support and resettlement councils - PMU	- IEMC, PMU
2	Vinh Ngoc Primary School Related to the construction of the northern WWTP (Component 1)	- Acquisition land area - Partial loss of pupil's playing ground - Exhaust gases, dust and noise, and wastes affecting pupils' health - Increased risks of traffic accidents due to construction transportation - Lessons affected by noise	- Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - If possible, implement the construction activities during the school summer vacation. - Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering. - Teachers to be informed of construction operations to keep pupils off the site during their break time. - Prohibit use of construction methods that cause noise during school learning hours. - Prohibit gathering of construction materials in front of the school. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site.	- Compensation, support and resettlement councils - PMU	- IEMC, PMU

			- Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Sett up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations, especially when school children go to and leave the school around construction area. - Tidy construction materials and stockpiles every working session. - Immediately address any issue/problem caused by the construction activities and raised by the school management.		
Construction stage					
3	Po Nagar Cham Tower Related to the construction of the stormwater and wastewater drainage systems on April 2 Street, and at PS2, PS3, CSO3 in Component 1 Related to the construction of roads and embankments on the northern bank of Cai river, and Chu Dong Tu Street in Component 2	- Increased dust and exhaust gases - Increased risks of traffic accidents - Temporary degradation of the landscape around the towers - More difficult access to the relics and possible traffic jams on April 2 Street section near Po Nagar Cham Towers - Increased construction wastes, waste water - Conflicts between workers and visitors	- Inform the Po Nagar Cham Tower management and the community of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction scheduleat least 01 month before start of the construction. - Prohibit gathering of construction materials in front of PoNagar Cham Towers. - Prohibit construction of workers camps within 100m from the PoNagar Cham Towers. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at the area of the PoNagar Cham Towers. - Clean the construction area after each working. - Apply speed limit at 10km/h within 100 m from thePoNagar Cham Towers - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session.	- Contractor	- PMU, CSC, IEMC

			- Reinforce trench walls with steel sheet piles for deep excavation to avoid subsidence. - Cover the incomplete trenches under construction at day's end. - Provide night lighting system with luminously painted fence and night lamp (7 pm to 6 am) - Carry out well worker management and avoid the conflict between workers and locals, visitors. - Immediately address any issue/problem caused by the construction activities and raised by the temple management.		
4	An Ton Church Related to the construction of stormater & wastewater drainage system on April 2 Street on Component 1	- Hindrance to access to the church - Increase in dust and exhaust gases, affecting visitors to the church - Increased construction wastes, waste water - Temporary degradation of the landscape - Risks of traffic accidents and community safety due to construction - Localized flooding becasue of construction during rainny days - Conflicts between workers and visitors to the church	- Inform the church management and the community 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. - Prohibit gathering of construction materials in front of the church. - Sprey sufficient water to suppress dust during dry and windy days at least three times a day at the area of the temple. - Clean the construction area after each working. - Apply speed limit at 10km/h within 50 m from the church - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at day's end. - Provide night lighting system with luminously painted fence and night lamp (7 pm to 6am) - Avoid construction activities during religious events every first and 15th days of the lunar month and during festival days if possible. - Immediately address any issue/problem caused by the construction activities and raised by the church management.	- Contractor	- PMU, CSC, IEMC

5	Bau market Related to the construction of stormater &wastewater drainage system on April 2 Street on Component 1;	- Localized flooding in market area - Risks of construction accidents to traders and customers - Interruption of business activities - Increased dust and exhaust gases, affecting market activities and goods - Traffic safety risks to the community, especially at night - Conflicts between workers and traders and customers.	- Inform the market management and the community of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02weeksbefore start of the construction. - Prohibit gathering of construction materials at the market. - Ensure a drainage ditch at the site and clean any clogs. - Provide a standby pump in case of localized flooding at the market. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Clean the construction area after each working. - Apply speed limit at 10km/h within 50 m from the market - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at day's end. - Providing night lighting system with luminously painted fence and night lamp. - Manage the worker force to any avoid the conflict with the local people and traders. - Immediately address any issue/problem caused by the construction activities and raised by the market management.	- Contractor	- PMU, CSC, IEMC
6	Ngoc Thuy Vihara Related to the construction of the southern embankment of	- Partial acquisition of land area of Vihara - Increased waste, dust, and exhaust gases - General landscape of the Vihara	- Inform the monastery 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. - Prohibit gathering of construction materials near the monastery. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site.	- Contractor	- PMU, CSC, IEMC

	Cai river of Component 2;	- Vibration caused by the construction machineries may affect the existing structures of monastery - Potential risks of traffic safety	- Clean the construction area after each working. - Sett up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at day's end. - Providing night lighting system with luminously painted fence and night lamp. - Avoid construction activity before 7:00 am and after 6:00 pm. - Immediately address any issue/problem caused by the construction activities and raised by the monastery.		
7	Ba Lang Parish Related to the construction of stormwater & wastewater sewers in Duong Hien Quyen , Pham Van Dong Street, pumping stations PS1 (50m) of Component 1	- Affecting the landscape owing to gathering of construction materials - Increased wastes, wastewater, dust, and exhaust gases affecting people going into the parish - Potential risks of traffic safety for the church goers	- Inform the Parish of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 02weeksbefore start of the construction. - Prohibit gathering of construction materials near the parish. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Clean the construction area after each working. - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at day's end. - Providing night lighting system with luminously painted fence and night lamp (7pm to 6am).	- Contractor	- PMU, CSC, IEMC

			- Immediately address any issue/problem caused by the construction activities and raised by the monastery.		
8	Vinh Hoa 2 Primary School Related to the construction of school sanitation block (Ngo Van So Street), the construction of stormwater &wastewater sewer line in Ngo Van So Street, pumping station PS4 of Component 1	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting pupils' health - Lessons affected by noise and vibration - Risks of traffic accidents to teachers and pupils due to construction transportation and other activities	- Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - If possible, implement the construction activities during the school summer vacation. - Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering (fence 2m tall). - Teachers to be informed of construction operations to keep pupils off the site during their break time. - Prohibit use of construction methods that cause noise during school learning hours. - Prohibit gathering of construction materials in front of the school. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site.	- Contractor	- PMU, CSC, IEMC
9	Mai Xuan Thuong Lower Secondary School Related to the construction of wastewater drainage system in Mai Xuan Thuong of Component 1	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries may affect wall, gate of school - Potential localized flooding	- Immediately collect any domestic wastes and construction spoils around the school and dispose in a designated site. - Prohibit construction of workers camps within 2 km from the school. - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations, especially when school children go to and leave the school around construction area. - Tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at day's end. - Providing night lighting system with luminously painted fence and night lamp. - Immediately address any issue/problem caused by the construction activities and raised by the school management.	- Contractor	- PMU, CSC, IEMC

10	Sao Bien Pre-School Related to the construction of wastewater drainage system in Mai Xuan Thuong of Component 1	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries may affect wall, gate of school - Potential localized flooding		- Contractor	- PMU, CSC, IEMC
11	Vinh Hoa 1 Primary School Related to the construction school sanitation blocks (Dien Bien Phu Street), the wastewater drainage line on Dien Bien Phu Street of Component 1	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration		- Contractor	- PMU, CSC, IEMC
12	Vinh Tho Primary School Related to the construction school sanitation	- Increased construction wastes, waste water, exhaust gases, dust and noise		- Contractor	- PMU, CSC, IEMC

	block (Ton That Tung Street) of Component 1	- Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration			
13	Vinh Hai 2 Primary School Related to the construction school sanitation block (Nguyen Khuyen Street) ò Component 1	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries		- Contractor	- PMU, CSC, IEMC
14	Market at Duong Hien Quyen and Dien Bien Phu intersection Related to the construction of wastewater drainage pipeline on Dien Bien Phu Street and Duong Hien Quyen Street of Component 1	- Increased dust, exhaust gases, noise, vibration, construction wastes, hazardous waste, domestic wastes, and wastewater. - Clogging of local drainage canal leading to localized flooding. - Increased traffic congestion and risks of traffic accidents due to construction and transportation.	- Inform the market management and the community 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. - Prohibit gathering of construction materials at the market. - Ensure a drainage ditch at the site and clean any clogs. - Provide a standby pump in case of localized flooding at the market. - Spray sufficient water to suppress dust during dry and windy days at least three times a day at site. - Clean the construction area after each working. - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations.	- Contractor	- PMU, CSC, IEMC

		- Hindering of access by the customers to the market. - Conflicts between workers and traders	- Ensure successive supply of materials according to construction schedule, and tidy construction materials and stockpiles every working session. - Cover the incomplete trenches under construction at the end of the day. - Apply speed limit at 10km/h within 50 m from the market - 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. - Immediately address any issue/problem caused by the construction activities and raised by the market management.		
15	Vinh Ngoc Primary School Related to the construction of the WWTP of Component 1	- Increased construction wastes, waste water, exhaust gases, dust and noise affecting students' health - Lessons affected by noise and vibration - Risks of traffic and works accidents to teachers and students - Vibration caused by the construction machineries may affect wall, gate of school - Potential localized flooding	- Inform the school management of the construction activities and their potential impacts such, waste, dust, and noise, traffic, and construction schedule at least 01 month before start of the construction. - If possible, implement the construction activities during the school summer vacation. - Construction area to be fenced and marked with warning signs to prevent pupils and unauthorized people from entering (fence 2.5 m tall). - Teachers to be informed of construction operations to keep pupils off the site during their break time. - Prohibit use of construction methods that cause noise during school learning hours. - Prohibit gathering of construction materials in front of the school. - 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. - Prohibit construction of workers camps within 200m from the school. - Set up construction and traffic warning signs at the construction site.	- Contractor	- PMU, CSC, IEMC

			- Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations, especially when school children go to and leave the school around construction area. - Apply speed limit at 10km/h within 100 m from the school - Tidy construction materials and stockpiles every working session. - Immediately address any issue/problem caused by the construction activities and raised by the school management.		
16	Power Company Related to the construction of Road No. 4 of Component 2	- Increased construction wastes, waste water,dust, and exhaust gases, - Increased risks of accidents - Potential localized flooding	- Inform the Power Company 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 fenced and marked with warning signs to prevent unauthorized people from entering. - 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 and near the company and dispose in a designated site. - Set up construction and traffic warning signs at the construction site. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and to guard high risk operations. - Tidy construction materials and stockpiles every working session. - Immediately address any issue/problem caused by the construction activities and raised by the company. - Arrange traffic guide for the vehicles go in/go out the company.	- Contractor	- PMU, CSC, IEMC
17	Railway Related to the construction of the pressure pipeline conducting wastewater to the	- Increased risks of railway accidents - Possibly interference with the train schedules - Risks of damage to railway infrastructure	- Inform the railway management company of the construction activities and their potential impacts such the risks of interference with the railway train schedule and railway traffic safety. - Inform the railway company of the detail construction work schedule at least 01 month before construction starts. - Set up construction and traffic warning signs at the construction site.	- Contractor	- PMU, CSC, IEMC

	WWTP passing the railway of Component 1; and the construction of Road No. 4 at least 15m from the railway slope foot of Component 2		- Set up barriers around the construction area to separate working area with the railway (fence 2.5 m tall). - Construct the sewer under passing the railway using safe tunneling method. - Deploy a qualified technical staff to supervise construction activities near the railway. - Only execute construction activities when there is no train schedule. - Prohibit scattering of construction material and wastes near and on the railway. - Deploy staff to guide the traffic during construction during transportation, loading and unloading of construction materials and wastes, and during transporting materials crossing the railway. - Immediately collect any domestic wastes and construction spoils around and near the railway and dispose in a designated site.		
18	Water supply pipeline Related to the area in front of the construction site of the WWTP, to be reinstated of Component 1	- Risks of breakage of the water supply pipeline	- Inform the water supply management company of the construction activities and their potential impacts such the risks of breakage other damages to the water supply pipelineat least 01 month before start of the construction. - Set up barriers around the construction area of water supply pipeline. - Use smaller excavation machine and Larsen pile driving method of construction to avoid breaking or disposition the water pipeline. - Deploy a qualified technical staff to supervise construction activities near the pipeline. - In the case of breaking the pipeline, it is necessary to suspend the construction activities and immediately inform the water supply company and the local authority of the incident.	- Contractor	- PMU, CSC, IEMC
19	April 2 Street Related to the construction of stormwater & wastewater drainage lines on April 2 Street of	- Typical impact: mostly related to traffic as construction operations will occupy one part of road surface, while the other part will be used for gathering machinery	- Informing the community of the construction schedule at least one week before the construction. - Place fences 2m tall and warning signs of construction at site. - 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.	- Contractor	- PMU, CSC, IEMC

	Component 1 and the material transport route of the subproject	and storage of construction materials during construction - Inconveniences to locals' business activities as access to business establishments will be obstructed - Affecting drainage capability - Dust, waste, damaged landscape - Risks of landslides and subsidence damages to existing works - Safety risks to vehicles and community, especially at night	- Reinforce trench walls with steel sheet piles for deep excavation to avoid subsidence. - Spray water three times per day to reduce dust during dry days. - Tidy up construction site during and after every working a session. - Safely cover incomplete construction items and the incomplete ditches at the end of the day. - Provide strong wooden planks or concrete slabs across the trench under construction for temporary access to the houses or businesses. - Provide night lighting system and luminously painted fences (7 pm to 6am). - Reinstall the road surface if occurring the damages during construction.		
20	Pham Van Dong Street Related to the construction of wastewater drainage line in Duong De-Vinh Hoa area of Component 1 and material transport route	- Risks of traffic accidents; - Inconveniences to locals' business activities - Affecting drainage capability - Dust, waste, damaged landscape - Risks of landslides and subsidence; damages to existing works	- Informing the community of the construction schedule at least one week before the construction. - Place fences 2m tall and warning signs of construction at site. - 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. - Reinforce trench walls with steel sheet piles for deep excavation to avoid subsidence. - Spray water three times per day to reduce dust during dry days. - Tidy up construction site during and after every working a session. - Safely cover incomplete construction items and the incomplete ditches at the end of the day. - Provide strong wooden planks or concrete slabs across the trench under construction for temporary access to the houses or businesses.	- Contractor	- PMU, CSC, IEMC

			- Provide night lighting system and luminously painted fences (7 pm to 6 am). - Reinstall the road surface if occurring the damages during construction.		
21	Areas along northern and southern banks of Cai river Related to the construction of northern and southern embankments of Cai river	- Excavated salinized sludge from Cai river (94,000m^3) - Increased turbidity of river water - Risks of labor accidents to workers from drowning and flooding - Increased dust and exhaust gases, affecting people - Increased construction wastes, waste water - Affecting drainage capability	- Informing the community of the construction schedule at least one week before the construction. - Meet and coordinate with the local authorities and fishermen to devise the construction plan, avoiding boat launching time, and work with them to find temporary alternative landing and morning sites. - Place fences 2.5m tall and warning signs of construction at site. - 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. - Prohibit construction during storm weather and flooding period. - Prepare and implement the detailed DMMP. - Spray water three times per day to reduce dust during dry days. - Tidy up construction site during and after every working a session. - Provide night lighting system and luminously painted fences. - Reinstall the road surface if occurring the damages during construction. - Safely cover the trucks transporting salinized dredged soils for ground leveling at the Provincial Urban and Administrative Center. - Execute construction section by section; constructing dikes with wood piles; filling earth for construction. - Maintain good worker camps at the site at least 200m from the river which include: dustbins, first aid kit, fire extinguishers, mobile onsite toilets on site, car wash station at least 500m from the river. - Avoiding gathering construction materials 200m within the river bank	- Contractor	- PMU, CSC, IEMC
22	Nguyen Khuyen Street	- Risks of traffic accident occurring on the transport routes	- 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	- Contractor	- PMU, CSC, IEMC

	Related to material transport route for the construction of Balancing lake, PS5, sewer connecting the balancing lake to Nguyen Khuyen, CSO1,CSO2, School sanitation of Vinh Hai Primary school No. 2, WWTP (Component 1), No.4 road (Component 2) Ending point connecting to the railway	- Impacts of dust, noise and emission affecting the health of traffic participants and residents - Risk of railway accident - Risk of damaged roads	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. - Pay attention to railway warning signs while crossing the railway.		
24	Nguyen Xien Related to material transport route for the construction of No.4 road Ending point connecting to the railway	- Risks of traffic accident occurring on the transport routes - Impacts of dust, noise and emission affecting the health of traffic participants and residents - Risk of railway accident - Risk of damaged roads		- Contractor	- PMU, CSC, IEMC
25	Hung Loc Hau Related to material transport	- Risks of traffic accident occurring on the transport routes		- Contractor	- PMU, CSC, IEMC

	route for the construction of WWTP, Rainwater pumping station (Component 1)	- Impacts of dust, noise and emission affecting the health of traffic participants and residents			
26	Dien Bien Phu Related to material transport route for the construction of Wastewater sewer pipeline, School sanitation of Vinh Hoa Primary school No. 1 (Component 1)	- Risks of traffic accident occurring on the transport routes - Impacts of dust, noise and emission affecting the health of traffic participants and residents		- Contractor	- PMU, CSC, IEMC
27	Administrative and Urban Center of Khanh Hoa province Related to the disposal area for salty soil arising from the dredging of Cai river and the digging soil of WWTP	- Risks of traffic accidents occurring on the transport routes - Impacts of dust, noise and emission may affect traffic participants and residents - 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		- Contractor	- PMU, CSC, IEMC

6.4. Specific Impacts and Mitigation Measures during Operation

6.4.1. For Wastewater Treatment Plant (WWTP) and Sewer System

Succesfful operation of the WWTP will depend on a number of factors including: i) selection of appropriate treatment technologies, the quality and quantity of raw wastewater and its variability; available land area for the treatment facility; ii) resources for capital expenditures, operation, maintenance, and repair; and iii) availability of skilled operators, operator training, maintenance personnel, treatment chemicals, and replacement parts.The following sections focus on the mitigation measures to address impacts of the WWTP on the environment during its operation. Institutional arrangement for the management of the WWTP is addressed in the techinical design documentation of the subproject.

(i) Measures to minimize impact on receiving waters

- Since the combined sewers will be used, minimize bypass of the treatment system by providing capacity sufficient to treat peak flows.
- An online monitoring system is to be installed at the WWTP for controlling the wastewater inflow, quality of the influent and effluent at the WWTP.
- The quality of sample effluent from the WWTP must be analyzed once every 3 months.
- Treatment facilities are to be periodically checked and maintained to ensure highest performance of the system.
- Troubleshooting plans must be prepared to respond promptly to incidents in due time (standby generators, standby pumps, discharge incident …) in order not to disrupt the operation of the plant.
- Based on an assessment of risks to human health and the environment, consider re-use of treated effluent, especially in areas with limited raw water supplies. Treated wastewater quality for land application or other uses should be consistent with the relevant public health-based guidance from the World Health Organization (WHO)[15] and applicable national requirements.

(ii) Odor control

Odor and air emission problems during the operation will be controlled with control measures integrated in the design of the WWTP as described in section 5.1.(i).The following measures are required to prevent, minimize, and control air emissions and odors during operation:

- Domestic waste and sludge generated during the operation of the plant will be safely stored in a closed area before being transported away by URENCO to serve the planting of urban green trees or to be dumped at Luong Hoa landfill of the city. This will reduce bad odors generated from sludge.
- Cover emission points (e.g., aeration basins, clarifiers, sludge thickeners, tanks, and channels), and vent emissions to control systems (e.g., compost beds, biofilters, chemical scrubbers, etc.) as needed to reduce odors and otherwise meet applicable national requirements and internationally accepted guidelines.
- The waste (sludge and domestic solid waste) will be contained in standardized containers to minimize dispersion and gases and solid waste into the environment.

[15]WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater (2006).

- There will be plans to periodically test and monitor air concentrations to obtain proper evaluation and control operation processes in a logical manner.

(iii) Sludge

- Sludge will be periodically monitored to identify any possible hazard: The quality of sludge is monitored periodically 3 months per time with heavy metal parameters are analyzed As, Cu, Cd, Pb, Zn according to QCVN03-MT:2015/BTNMT – national technical regulation on allowable limits of the heavy metals in the soils
- Sludge will be compacted with gravity compactors and dewatered with gravity belt compressors. Dried mud cakes will be stored in a roofed warehouse at the sludge dewatering area. Periodically one time per month, the plant will hire URENCO to transport this sludge amount way to serve the planting of urban green trees or to be dumped at Luong Hoa solid waste landfill of the city.
- Compressed raw waste will be put in 6m^3containers. Full containers will be replaced with empty ones and disposed of at Luong Hoa landfill.
- Land application or other beneficial re-use of the WWTP residuals should be considered but only based on an assessment of risks to human health and the environment. Quality of residuals for land application should be consistent with the relevant public health-based guidance from the World Health Organization (WHO)[16] and applicable national requirements.
- Processing, disposal and re-use of wastewater treatment plant residuals should be consistent with applicable national requirements.
- URENCO will be employed to periodically dredge sludge from sewer systems and transport this sludge for disposal at Luong Hoa landfill. Transportation will be carried out by specialized tank trucks to avoid odor emission and sludge spillage along the route

(iv) Flow regime and flooding

As assessed in Section A.3.2.3.1 (iv),the existing ditch can completely secure the reception of 15,000m^3/day from the WWTP (with a water level rise by about 10cm). To prevent stormwaterfrom overflowing into the plant, protection and drainage solutions have also been integrated in the design as presented in Section 5.1.(i).The subproject proposal has also mentioned the construction of a pumping station to pump stormwater into Cai river when the water level in the plant area rises high.

(v) 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.

(vi) 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.

[16] WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater (2006).

- Once every 2-3 months, the WWTP will have to employ a local tasked with handing hazardous waste to collect, transport and handle such waste.
- Empty chlorine containers are to be returned to manufacturers.

(vii) Worker health and safety at the WWTP, pump stations, and sewer systems

Worker occupational health and safety impacts associated with theoperational phase of the WWTP primarily include the following: i) Accidents and injuries; ii) Chemical exposure; ii) Hazardous Atmosphere; and iii) Exposure to pathogens and vectors.

Accidents and Injuries:

Work at the WWTP is often physically demanding and may involve hazards such as open water, trenches, slippery walkways, working at heights, energized circuits, and heavy equipment. Work at the WWTP may also involve entry into confined spaces, including manholes, sewers, pipelines, storage tanks, wet wells, digesters, and pump stations. Methane generated from anaerobic biodegradation of sewage can lead to fires and explosions.

The following procedures required to prevent, minimize, and control accidents and injuries at water and sanitation facilities:

The following procedures are required to prevent, minimize, and control chemical exposure at the WWTP:

- Install railing around all process tanks and pits.
- Implement a confined spaces entry program that is consistent with applicable national requirements and standards. Valves to process tanks should be locked to prevent accidental flooding during maintenance.
- Use fall protection equipment when working at heights.
- Maintain work areas to minimize slipping and tripping hazards.
- Implement fire and explosion prevention measures in accordance with the national regulation.
- Ventilate enclosed processing areas and ventilate equipment, such as pump stations, prior to maintenance.
- When installing or repairing the sewers and stormwater drainage sewers adjacent to roadways, implement procedures and traffic controls, such as:
    - Establishment of work zones so as to separate workers from traffic and from equipment as much as possible.
    - Reduction of allowed vehicle speeds in work zones.
    - Use of high-visibility safety apparel for workers in the vicinity of traffic.
    - For night work, provision of proper illumination for the work space, while controlling glare so as not to blind workers and passing motorists.
- Locate all underground utilities before digging.

Chemical Exposure and Hazardous Atmospheres:

- The chlorine station must be equipped with chlorine leakage detectors, ventilation facilities, sirens, flashing warning lights, gas masks, compressed oxygen breathing apparatuses, protective clothing, and a system of emergency watering/showering/ eyewash of the chlorination house.

- Implement a training program for operators who work with chlorine regarding safe handling practices and emergency response procedures.
- Provide appropriate personal protective equipment (including, for example, self-contained breathing apparatus) and training on its proper use and maintenance.
- Prepare escape plans from areas where there might be a chlorine or ammonia emission. In case of chlorine leakage in the storage room, detectors will find out leaks and send out sound alarms, visible signals, and alarm signals via the SCADA system to the operation screen in the central control room. The ventilation fans of the chlorine storage room would stop operating, and the chlorine room will be sealed completely (the rails of the shutter doors would normally open to the inside during normal ventilation). The sprinkler system will then be manually started by operators to reduce escaping gas pressure. Heavy chlorine gas will be sucked out by filter suction fans and through filtering devices, where chlorine will be neutralized by a solution of 20%caustic soda (NaOH).
- Install safety showers and eye wash stations near the chlorine equipment and other areas where hazardous chemicals *such* as chlorine and soda (NaOH) are stored or used.
- Use protective goggles, protective clothes and boots, chlorine masks, and personal gas detection equipment while working at the WWTP.
- Monitoring chlorine gas in the air: Before being discharged it into the surrounding if chlorine levels of exceed permissible maximum concentrations with alarm signals from the gas analyzer, the air purification system must be initiated.
- Periodically sample air quality in work areas for hazardous chemicals. If needed to meet applicable occupational health national requirements or internationally accepted standards, install engineering controls to limit worker exposure, for example collection and treatment of off-gases from air stripping;
- Prohibit eating, smoking, and drinking except in designated areas.
- Rotate personnel among the various treatment plant operations to reduce inhalation of air-stripped chemicals, aerosols, and other potentially hazardous materials.

Pathogens and Vectors:

The measures to prevent, minimize, and control exposure to pathogens and vectors include:

- Include in safety training program for workers, safe handling and personal hygiene practices to minimize exposure to pathogens and vectors.
- Use vacuum trucks or tugs for removal of fecal sludge instead of manual methods.
- Provide and require use of suitable personal protective clothing and equipment to prevent contact with wastewater (e.g., rubber gloves, aprons, boots, etc.). Especially provide prompt medical attention and cover any skin trauma such as cuts and abrasions to prevent infection and use protective clothing and goggles to prevent contact with spray and splashes.
- Provide areas for workers to shower and change clothes before leaving work and provide laundry service for work clothes. This practice also helps to minimize chemical and radionuclide exposure;
- Encourage workers at wastewater facilities to wash hands frequently.
- Provide worker immunization (e.g. for Hepatitis B and tetanus) and health monitoring, including regular physical examinations.

- Reduce aerosol formation and distribution, for example by:
    - Planting trees around the aeration basin to shield the area from wind and to capture the droplets andparticles.
    - Using diffused aeration rather than mechanical aeration and using finer bubbles for aeration.
    - Reducing aeration rate, if possible.
    - Use of floating covers on the mixed liquor of the aeration basin.
    - Suppression of droplets just above the surface, (e.g.by installing a screen or mesh above the basin).
    - Collection of droplets (e.g. by sedimentation, scrubber, electrostatic precipitator, or fabric filter).
    - Disinfection of airborne particles (e.g., by using ultraviolet lights).
    - Use of submerged effluent collector (such as pipes with orifices) rather than weirs.
- Avoid handling screenings by hand to prevent needle stick injuries.
- Maintain good housekeeping in sewage processing and storage areas.
- Advise individuals with asthma, diabetes, or suppressed immune systems not to work at wastewater treatment facilities, especially composting facilities, facility because of their greater risk of infection.

(viii) Leaks and Overflows

Leaks and overflows from the sewerage system can cause contamination of soil, groundwater, and surface water. Overflows occur when the collection system can not manage the volume of wastewater, for example due to high flows during rain events or as the result of power loss, equipment malfunctions, or blockages.

Recommended measures to prevent, minimize, and control leaks and overflows include:

- Consider the installation of separate sewer systems for domestic wastewater and storm water runoff in the overall planning and design of new sewerage systems.
- When on-site sanitation systems where excreta are mixed with water predominate, consider use of small-diameter sewerage system to collect water effluent from septic systems or interceptor tanks.
- Limit the sewer depth where possible (e.g., by avoiding routes under streets with heavy traffic). For shallower sewers, small inspection chambers can be used in lieu of manholes.
- Use appropriate locally available materials for sewer construction. Spun concrete pipes can be appropriate in some circumstances but can suffer corrosion from hydrogen sulfide if there are blockages and/or insufficient slope.
- Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation.
- Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replace if broken to minimize entry of garbage and silt into the system.
- Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas.

- Establish routine maintenance program, including:
    - Development of an inventory of system components, with information including age, construction materials, drainage areas served, elevations, etc.
    - Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. Cleaning activities may require removal of tree roots and other identified obstructions.
    - Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration.
    - Monitoring of sewer flow to identify potential inflows and outflows.
- Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);
- Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
- When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

(ix) Incidental discharge from the WWTP:

- Prepare an emergency plan for incidental discharge of untreated waste water and conduct emergency training for the operators.
- Inform the residents of the incident and mitigation measures.

The WWTP system includes the components of biological treatment tank, flocculation tank, biological aeration tank, and bio-filters which will be designed with the two modules running in parallel to remedy any incident when it happens, specifically:

- In case incidents due to breakage, damage, or leakage:
- Normally, a problem – if any - happens in only one module, the WWTP Company will operate the remaining module while repairing the malfunctioning one. If fixing the incident takes too much time, exceeding the storage time of work items in the system, the Company will suspend operation to solve the said incident problem.
- In case of incidents with devices (wastewater pumps, air blowers, ...):
- All the devices in the WWTP system are equipped with one backup device. Thus, if case of errors occurring with a device, the Company will make use of the standby device and have the faulty one repaired.
- In case of incidents caused by operation:

- When a problem occurs, the technical division and the operating worker will have to review all operational parameters and make adjustments in conformity with the design.
- In case of serious incidents, e.g. the system is unable to work and the treated wastewater fails to meet the standards of discharging treated water and pollutes the environment for a long time, the Company will report this incident to the management agency, i.e. Khanh Hoa Department of Natural Resources and Environment, and suspend production to fix the problem. The Company will employ an expert on wastewater treatment to make inspection and adjustments to the system.
- Corrective measures are to be promptly carried out for the treatment plant to be operated again in the soonest possible time.
- Standby generators must be always available.

6.4.2. For School Sanitation Blocks

- Arranging workers to regularly clean school toilets.

The schools provide training and awareness raising campaign in school clean water and sanitation for the school children including using hygienic drinking water, washing hand with soap, and school and environmental sanitation.

6.4.3. Responsibilities for the implementation

The operating unit has responsible for implementing environmental mitigation measures during operation of the project. Responsibilities for the implementation areshown in the table 6-5 below:

Table 6-4. Responsibilities for implementation of mitigation measures in operation phase

Pipelines	Pumping stations, WWTP	Road	Sanitary facilities for schools
Owner is Nha Trang city PC. Representative of owner: PMU for Public Service Works Operator: Khanh Hoa Water Supply Sewerage & Drainage Company (Khasswaco) according to the contract signed with Nha Trang city PC	Owner is Nha Trang city PC. Representative of owner: PMU for Public Service Works Operator: Phu Dien - SFC J/v according to to the contract signed with Nha Trang city PC	Owner is Nha Trang city PC/Department of Transportation. Representative of owner: PMU for Public Service Works / Division of Transport Infrastructure Management Operator: 2/4 Nha Trang Company Ltd/ Khánh Hòa Transportation Construction and Management Joint Stock Company according to the contract	Owner is Nha Trang city PC/ Department of Education and Training Representative of owner: Division of Education and Training of Nha Trang/ Department of Education and Training Operator: operated by schools at their own expenses

6.5. Role and Responsibilities for ESMP Implementation

6.5.1. 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 beresponsible for implementing mitigation measures. These measures will be included in bidding documents and their costs are to be 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.

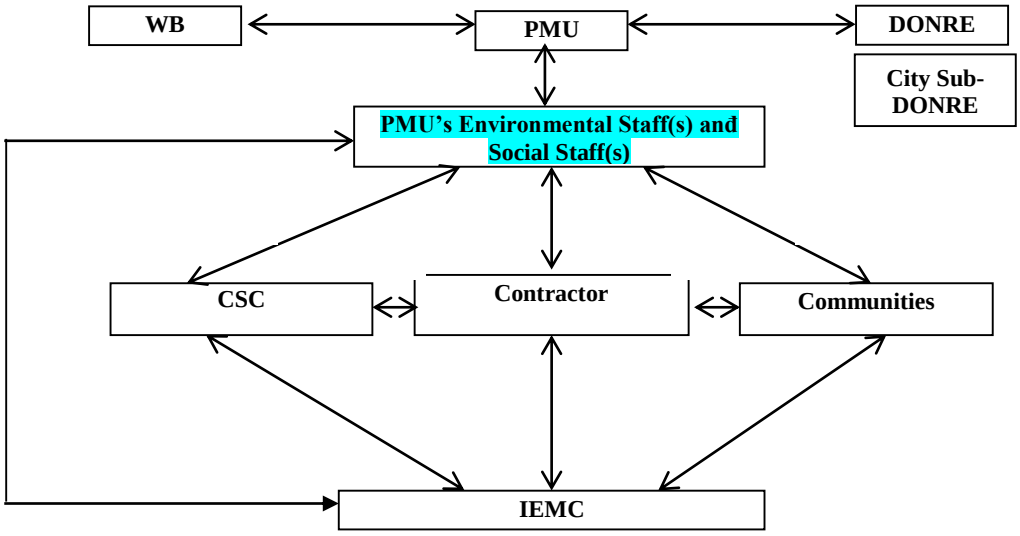


Figure 6-1. Organization chart for ESMP Implementation

Table 6-5. Roles and responsibilities of key parties

Community/ Agencies	Responsibilities
PMU (Khanh Hoa Development Project Management Unit)	- PMU will be responsible for monitoring the overall subproject implementation, including environmental compliance of the subproject. PMU will have the final responsibility for ESMP implementation and environmental performance of the subproject during the construction and operational phases. - Specifically the PMU will: (i) closely coordinate with local authorities in the participation of the community during subproject preparation and implementation; (ii) monitor and supervise ESMP implementation including incorporation of ESMP into the detailed technical designs and bidding and contractual documents; (iii) ensure that an environmental management system is set up and functions properly; (iv) be in charge of reporting on ESMP implementation to the DONRE and the World Bank. - In order to be effective in the implementation process, PMU will assign Environmental Staff(s)(ES) to help with the environmental aspects of the subproject.

PMU Environmental and Social Staff(s) (ES)	- The ES is responsible for monitoring the implementation of the World Bank's environmental and social safeguard policies in all phases and process of the Project. Specifically, ES will be responsible for: (i) helping PMU incorporate ESMP into the detailed technical designs and civil works bidding and contractual documents; (ii) helping PMU incorporate responsibilities for ESMP and RAP monitoring and supervision into the TORs, bidding and contractual documents for the Construction Supervision Consultant (CSC) and other safeguard consultant (IEMC) as needed; iii) providing relevant inputs to the consultant selection process; (iv) reviewing reports submitted by the CSC and safeguard consultants; (v) conducting periodic site checks; (vi) helping the PMU on solutions to handle social and resettlement issues of the subproject; and vii) preparing environmental and social performance section on the progress and review reports to be submitted to the DONRE and the World Bank.
Construction Supervision Consultant (CSC)	- The CSC will assgin Environmental and Social Staff(s) and will be responsible for routine supervising and monitoring all construction activities and for ensuring that Contractors comply with the requirements of the contracts and the ECOP. The CSC will engage sufficient number of qualified staff (e.g. Environmental Engineers) with adequate knowledge on environmental protection and construction project management to perform the required duties and to supervise the Contractor's performance. - The CSC will also assist the PMU in reporting and maintaining close coordination with the local community.
Contractor	- 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) and Dredging Material Management Plan (DMMP) (if any) 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.
Independent Envionmental Monitoring	- 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

Consultants (IEMC)	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.
Local 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.
Province and City People's Committees (PPCs/DPCs), Provincial DONRE	- Oversee implementation of subprojects under recommendations of DONRE and PMU to ensure compliance of Government policy and regulations. DONRE is responsible for monitoring the compliance with the Government environmental requirements.

Evaluation of PMU'sexisting capabilities

Regarding project implementation experience:

The Coastal Cities Environmental Sanitation Project–NhaTrangSub-Project funded by the World Bank for the period of 2006-2014 was well managed by Nha Trang City Environmental Improvement PMU, which has been highly appreciated by line agencies and the World Bank.

The project management and implementation proceduresin accordance with WB requirements have been available in the CCESP. Yet, these may need to be upgraded to meet the donor's new requirements and at the same time lessons have to be learned and weaknesses in the previous CCESP have to be remedied.

And, like in the CCESP, a number of consulting activities assisting project implementation in the CCSEP are expected to be carried out such as assistance to procurement activities or the evaluation of the completed project.

Capability of staff:

The current staff of Khanh Hoa Development Project Management Unit are mainly from the former Nha Trang City Environmental Sanitation PMU with supplements of a number of staff with lots of ODA project experience, who are expected to implement effectively this CCSEP. Currently, there are 33 staff including 01 environmental engineer, 01 master and 3 resettlement/social bachelors in PMU. The PMU team has capable of monitoring and environmental management.

In addition, to enhance the management capability of the PMU, training has recently been provided by the PMU to improve its staff's professional competence in many main principal fields: (i) 03 of the staff granted PMP certificates by MPI; (ii) 16 certified to have been trained in PMP; (iii) 18 granted certificates of project management (Vietnamese programs); (iv) 19 granted certificates of advanced procurement and online procurement; (v) 05 granted certificates for pricing engineers of grade II and 01 granted a certificate for pricing engineers of grade I; (vi) 05 granted certificates of construction supervision; (vii) 09 certified to have attended courses on construction estimation and pricing; (viii) 04 granted certificates of chief accountants; and (ix) 01 granted a certificate of international pricing.

With a staff of most young officers (38 of age on average), who are active and creative with fairly even possession of professional qualifications in all construction aspects (civil, traffic, irigation, infrastructure) and economic-financial fields , the PMU is confident to assert that it can meet all the criteria to play the role of an Employer in the management of projects for civil engineering, irrigation works, and urban infrastructureof the scope of First Grade Works and Project Group A.

From the above mentioned information on the PMU's staff, the PMU can be believed to fully meet the criteria of assuming the Employer's role in projects of the said domains and meet the conditions required by the Donor.

In spite of this, according to new Vietnamese regulations to be promulgated in upcoming time, the staff/internal control division of the PMU will need to be supplemented.Additionally, it will be necessary for the PMU to be staffed with more experts in project management, contract management as well as technical and supervisory Social/environmental safeguards personnel for the Project.

In addition, as the CCESP ended in 2014 and the CCSEP will last until 2022, some knowledge and experience previously obtained regarding WB and Vietnamese regulations will have to be supplemented or replaced, and these will have to be updated during the implementation of the Project.

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.

6.5.2 Environmental Compliance Framework

(i) 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.

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.

(ii) 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.

(iii) 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 all phases of the Project. Environmental quality monitoring will be report periodically to PMU and World Bank (respectively every 03 months for PMUand every 6 months for WB in construction phase).
- IEMC will also supply specialized assistance to PMU and ES in environmental matters.

(iv) 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 site environmental management system of contractors including their performance, experience and handling of site environmental issues, and provide corrective instructions;
- Review the ESMP implementation by the contractors, verify and confirm environmental supervision procedures, parameters, monitoring locations, equipment and results;
- Report ESMP implementation status to PMU and prepare the environmental supervision statement during the construction phase; and

(v) Compliance with Legal and Contractual Requirements

The constructions activities shall comply not only with contractual environmental protection and pollution control requirements but also with environmental protection and pollution control laws of the Socialist Republic of Viet Nam.

All the works method statements submitted by the 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.

(vi) Environmental Claims and Penalty System

In the compliance framework, if non-compliance with 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 performs the repairs within the grace period (confirmed by CSC/PMU), no penalty is incurred and keeping money will be pay. 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 keeping 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.

(vii) Reporting Arrangements

ESMP monitoring and reporting requirements are summarized in table 6-7.

Table 6-6. 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
5	PMU	DONRE	Every three-month
6	PMU	WB	Every six-month

6.5.3. Estimated Costs for Each Work of Environmental Protection Measures

Table 6-7. Costs for environmental protection items

NO.	Works	Costs (estimated)
1	Renting areas for dumping mud/dredged soil	VND 200 million
2	Construction site fencing	VND 200 million
3	Prevention and control of fire and explosion(fire extinguishers, fire hoses, emergency lights)	VND 200 million
4	Watering and sprinkling	5 million/month
5	Trash bins on site	VND 50 million
6	Portable toilet	VND 60 million
7	Standby pump	VND 150 million
8	Planting trees at the treatment plant	VND 300 million
9	Wastewater treatment plants, sewer lines, drainage lines	VND 34.156.897 million
10	Demining	VND 700 million

6.6. Environmental Monitoring Program

6.6.1. Monitoring Location, Parameters and Frequency

The Environmental monitoring program is implemented in three stages of the project: before construction phase; construction phase; operational phase:

Preparation and construction phase:

Table 6-8. Location, parameters and frequency of monitoring

No	Monitored items	Preparation and construction phase
I	Monitoring of air quality	
	1. Monitoring parameters	noise, TSP, CO, NO_2, SO_2, HC, H_2S, microclimate
	2. Monitoring frequency	Preparation phase: oneobtained for determining base conditions Construction phase: measurements taken every three-months
	3. Applied Regulation	QCVN 05 :2013/BTNMT, QCVN 06:2009/BTNMT
	4. Monitoring positions	**KK1** – Air samples obtained at the area of northernwastewater treatment plant **KK2-** Air samples obtained at Nguyen Khuyen Street area (near the railway) - Area of building sewers to balancing lake, Road No. 4 **KK3-** Air samples obtained at Duong Hien Quyen Street – Pham Van Dong Street intersection (construction of collection sewers) **KK4** – Air samples obtained atPham Van Dong Street area near Vinh Hoa 2 Primary School (construction of collection sewersin Duong De area) **KK5** – Air samples obtained at 2/4 Street near Xom Bong bridge **KK6** – Air samples obtained near Ngoc Hiep Resettlement Site (taken on Huong Lo Ngoc Hiep Street) **KK7** – Air samples obtained at balancing lake area (from Nguyen Khuyen Street near the railway to Phu Xuong) **KK8-9** – Air samples obtained at the construction area of Southern sewer pipeline of Nha Trang city
II	Surface Water Quality Monitoring	
	1.Monitoring parameters	pH, temperatures, salinity, TSS, BOD5, NH4+, Cl-, T-N, T-P, Fe, As, Mn, total oil, coliform
	2. Monitoring frequency	Preparation phase: oneobtained for determining base conditions Construction phase: measurements taken every three - months
	3. Applied Regulation	QCVN 08-MT:2015/BTNMT
	4. Monitoring positions	**NM1 –** Surface water samples obtained in creek close to treatment plant (planned discharge point) - Creek connected with Cai river **NM2 –** Surface water samples obtained at the end of creek joining Cai river **NM3 –**Cai river water samples obtained at southern embankment area (close to Huong Lo Ngoc Hiep Street) - upstream Cai river (Ngoc Hiep area) **NM4 –**Cai river water samples obtained at southern embankment area (near Ha Ra bridge) - downstream Cai river **NM5 –** Cai river water samples obtained at northern embankment area (near foot of Xom Bong bridge) – downstream Cai river **NM6-** Cai river surface water samples obtained at discharge gate CSO3 (near existing Ditch next to Son Thuy shipyard)
III	Wastewater quality monitoring	

No	Monitored items	Preparation and construction phase
	1.Monitoring parameters	pH, TSS, BOD5, COD, NH4+, T-N, T-P, Fe, As, Cr, Cu, Zn, Pb, total oil and grease, coliform
	2.Monitoring frequency	Measurements taken every three - months
	3. Applied Regulation	QCVN 14:2008/BTNMT
	4. Position monitoring	**NT1** – Wastewater at existing discharge gate (Tran Phu Street) – COS5 area **NT2** –Wastewater at existing ditchdischarging into Cai river section adjoining northern embankment area (Thong Nhat Cooperative) **NT3 –** Wastewater at discharge gate at the end of Nguyen Khuyen Street adjacent to the railway (area for construction of COS) **NT4** – Wastewater at existing ditchin Duong De area (near Vinh Hoa 2 Primary School) **NT5**- Wastewater at sewer in 2/4 Street
IV	Soil	
	1. Monitoring parameters	pH, As, Hg,Cd, Cr, Cu, Pb, Zn
	2. Monitoring frequency	Preparation phase: oneobtained for determining base conditions Construction phase: measurements taken every6 months
	3. Applied Regulation	QCVN 03-MT :2015/BTNMT
	4. Monitoring positions	**S1-2**– Soil samples obtained at balancing lake close to the railway (end of Nguyen Khuyen Street intersecting the railway) **S3-4** – Soil samplesobtainedat Administrative and Urban Center of Khanh Hoa province **S5-6** – Soil samples taken in WWTParea
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

Table 6-9. Summary of number of monitoring samples

Total construction time	Monitoring frequency	Total sessions of monitoring	Samples of air, noise	Wastewater samples	Total samples of surface water	Soil samples
48months	Every 3 months	16	144	80	96	96

Operation phase:

No	Monitored items	Operation phase
I	Wastewater Monitoring	
	1. Monitoring parameters	flow, pH, temperatures, DO, TDS, TSS, BOD5, COD, DO, H_2S, NH_4^+, NO_3^-, PO_4^{3-}, oil and grease, Surfactant, coliform

No	Monitored items	Operation phase
	2. Monitoring frequency	Online daily measurements of flow, pH, temperature, DO, TSS, TDS, BOD_5 Quality monitoring every 3 months
	3. Applied standard	QCVN 40:2011/BTNMT;
	4. Monitoring positions	Wastewater influent and effluent
II	Monitoring of sludge	
	1. Monitoring parameters	volume, Cu, As, Zn, Pb, Cd, Cr
	2. Monitoring frequency	Measurements taken every 3 months
	3. Applied standard	QCVN 03-MT:2015/BTNMT, QCVN 50:2013/BTNMT
	4. Monitoring positions	Sludge treatment area
III	Monitoring of solid waste	volume, composition
	1. Monitoring parameters	Statistical data of volume of generated solid waste and hazardous waste
	2. Monitoring frequency	Monthly
	3. Monitoring positions	Storehouses

6.6.2 Estimated Costs for Environmental Monitoring Program

Table 6-10. Monitoring costs

No	Name of analysis index	Unit	Quantity	Price (VND)	Sub-Total
I	***Air samples***				
1	Microclimate (temperatures, humidity, wind speed, wind direction)	sample	144	83,994	12,095,136
2	Total suspended particles	sample	144	76,297	10,986,768
3	NO2	sample	144	185,742	26,746,848
4	SO2	sample	144	210,554	30,319,776
5	CO	sample	144	200,000	28,800,000
6	H2S	sample	144	258,067	37,161,648
7	HC	sample	144	311,130	44,802,720
8	Noise level	sample	144	71,927	10,357,488
	Total I		144	***1,397,711***	**201,270,384**
II	***Surface water samples***				
1	pH	sample	96	40,180	3,857,280
2	Temperatures	sample	96	14,847	1,425,312
3	Salinity	sample	96	40,180	3,857,280

4	SS	sample	96	84,341	8,096,736
5	BOD_5	sample	96	122,596	11,769,216
6	NH_4^+-N	sample	96	110,984	10,654,464
7	Cl^-	sample	96	89,005	8,544,480
8	T-N	sample	96	171,195	16,434,720
9	T-P	sample	96	112,387	10,789,152
10	Mn	sample	96	129,704	12,451,584
11	Fe	sample	96	115,140	11,053,440
12	As	sample	96	130,637	12,541,152
13	Oil &grease	sample	96	368,284	35,355,264
14	Coliform	sample	96	109,454	10,507,584
	Total II		96	**1,638,934**	**157,337,664**
III	***Wastewater samples***				
1	pH	sample	80	40,180	3,214,400
2	SS	sample	80	84,341	6,747,280
3	BOD_5	sample	80	122,596	9,807,680
4	COD	sample	80	172,114	13,769,120
5	NH_4^+-N	sample	80	110,984	8,878,720
6	T-N	sample	80	171,195	13,695,600
7	T-P	sample	80	112,387	8,990,960
8	Fe	sample	80	115,140	9,211,200
9	As	sample	80	130,637	10,450,960
10	Cu	sample	80	130,000	10,400,000
11	Pb	sample	80	130,000	10,400,000
12	Cr	sample	80	199,662	15,972,960
13	Zn	sample	80	129,704	10,376,320
14	Oil &grease	sample	80	368,284	29,462,720
15	Coliform	sample	80	109,454	8,756,320
	Total III		80	***2,126,678***	**170,134,240**
IV	***Soil samples***				
1	pH	sample	96	33,902	3,254,592
2	Hg	sample	96	392,052	37,636,992
3	As	sample	96	392,052	37,636,992
4	Cd	sample	96	332,819	31,950,624
5	Cu	sample	96	292,330	28,063,680
6	Pb	sample	96	332,819	31,950,624
7	Cr	sample	96	292,330	28,063,680
8	Zn	sample	96	292,330	28,063,680
	TotalIV		96	***2,360,634***	**226,620,864**
Grand total					**755,363,152**

6.7. Capacity Building Program

The table 6-12 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 6-11.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 Estimates

The following table provides a cost estimate for the implementation of environmental management plan (ESMP). The cost of ESMP[17] 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

[17]Excluding costs for RP implementation and independent monitoring the performance of RP/EMP

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 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 6-12. Estimated costs of EMP implementation (USD million)

Content	Items of Nha TrangSub-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	0.034	WB
(e) Independent environmental monitoring consulting(IEMC)	0.087	WB
(f) Capacity building programs on safeguard policies	0.01	WB

Table 6-13. Estimated costs of IEMC (Exchange rate: 1 USD = 22,230 VND)

No	Content	Unit	Amount	Unit price (VND)	Sub-total (VND)	Sub-total (USD)
1	Experts'salary	person-month	45	30,000,000	1,350,000,000	60,728.7
2	Accommodation, expenses for business trip	person-day	640	350,000	224,000,000	10,076.5
3	Travel expenses	Trip/ person	76	6000,000	456,000,000	20,512.8
4	Courseorganization	Class	8	5,000,000	40,000,000	1,799.4
5	Stationery and communications	Monitoring session	16	5,000,000	80,000,000	3,598.7

6	Environmental quality monitoring	Table	755,363,152	33,979.4
	Total		2,905,363,152	130,695.6

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 DISCLOSURE

7.1. Public Consultation Process

The World Bank's policies on Environmental Assessment (OP/BP 4.01) and Involuntary Resettlement (OP/BP 4/12) require that the Project Affected People (PAPs) and local authorities be provided with notification and consultation during the preparation of the subproject safeguard instruments. The CCSEP project is a Category A project, thus it is required by Bank safeguard policies to carry out the public consultation at least twice during the environmental assessment process.

Public consultation in preparation of the subproject ESIA also must comply with the requirements in the Government's Decree No. 18/2015/ND-CP dated 14 February 2015 on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plan, and Circular No. 27/2015/TT-BTNMT dated 29 May 2015 of the Ministry of Natural Resources and Environment on strategic environmental assessment, environmental impact assessment and environmental protection plan.

The objectives of public consultation are as follows:

- To share all information on the items and tentative activities of the Subproject with local community and stakeholders;
- To gather opinions/comments and concerns from local authorities and the community on local particularities and environmentally sensitive matters in the subproject area, especially matters that the environmental assessment impact group has not been aware of. On such basis, the concerns of the local community may be proposed for proper settlement during the selection of subproject design options;
- To collect opinions/comments from the local community on the Subproject's tasks in the preparation of the ESIA as well as comments on the draft ESIA to adequately and precisely assess environmental impacts and propose the most effective and feasible mitigation measures for negative environmental impacts.

7.1.1. Consultation with Ward/Commune People's Committees and Departments

The Employerof the subproject – Khanh Hoa Development Subproject Management Unit – issued Dispatch No. 312/BQL-KT dated 30 June 2016 on carrying out consultation with the People's Committees of wards/communes in the Subproject area (Vinh Hoa, Vinh Hai, Vinh Phuoc, Vinh Tho, Vinh Ngoc, Ngoc Hiep, Van Thang, Loc Tho, Phuoc Long, Phuoc Hoa, Xuong Huan, Van Thanh, Phuoc Tien, Phuoc Tan, Phuong Sai, Phuong Son, Vinh Nguyen, and Tan Lap) for their opinions on the Subproject's environmental impacts and mitigation measures.

Township/commune-level People's Committees have also responded with opinions and recommendations on environmental impacts of the Subproject and on the implementation of mitigation measures for adverse impacts.

On 28 April 2016, a consultation meeting on social and environmental safeguard issues of the Subproject was held and was attended by the departments and agencies with representatives from the PMU, Khanh Hoa Provincial Land Fund Development Center, the Department of Labor, Invalids and Social Affairs, the Environmental Protection Agency, Nha Trang Urban Management Division, Nha Trang City Fatherland Front, the Division of Natural Resources and Environment, the Land Price Division, the Pricing Division and the Department of Construction.

7.1.2. First and Second Public Consultation

1st consultation:

Khanh Hoa Development Subproject Management Unit, in co-operation with the local authorities, conducted the first consultation with the local residents on the environmental and social issues, environmental protection, and sanitation measures of the Subproject on February 18-27, 2016. The total number of participants were 444 persons/18 wards/communes, of which women accounted for 41.7%.

The participants were as follows:

- Representatives of the subsubproject Employer;
- Representatives of the local government authorities;
- Representatives of the ESIA Consultant;
- Representatives of the affected communities.

The consultation contents included:

- To present briefly information and proposed contents of the subproject and it's benefits.
- To present the main expected impacts of the subproject and the scope of the subproject ESIA.
- To consult with the local residents and authorities for their comments/ideas about the local environmental issues that need to be considered during ESIA process.
- The participants were encouraged to provide comments, advices and questions.

2nd consultation:

Khanh Hoa Development Subproject Management Unit, in co-operation with the local authorities, conducted the second consultation with the local residents about the environmental and social issues, environmental protection, and sanitation measures of the Subproject on July 4-9, 2016 after the draft ESIA was available. A total of 474 persons/18 wards/communes, of which women accounting for42% participated in this 2nd consultation.

The participants included:

- Representatives of the subsubproject Employer;
- Representatives of the local government authorities;
- Representatives of the ESIA Consultant;
- Representatives of the affected communities.

The consultation contents included:

- Disseminating information on the Subproject: distribution of summary materials on the more detailed subproject contents, construction items in the communes, and the map of the construction area;
- Presenting findings of the ESIA on the positive and negative social and environmental impacts when the Subproject is implemented;
- Presenting proposed measures to mitigate negative impacts on the natural and social environment;
- Consulting leaders and local people about social and environmental issues.

7.2. Public Consultation Results

7.2.1. Opinions from Ward/Commune People's Committee and Departments

Table 7-1. Summary of local authorities' opinions

Local authorities' opinions	Correspondance by PMU
- Agreeing on and expressing support to subproject implementation to improve overall environmental sanitation in city; - Reasonable and sound compensation policies for affected people to be worked out; - Expected employment of local labor when implementing the Subproject; - Need of proper traffic safety measuresduring construction stage; - Compensation for any damages caused to local houses by construction operations;repair or reinstatement of public works such as roads damaged by subproject construction operations; - Survey and design to be thoroughly carried out to solve environmental sanitation problems; - Construction site areas to be tidied up after construction; - The Employer is to consider households far from tertiary sewer line who need to be connected to the lineand include these into technical design; - Ward people's committeesto propagate information to local people; however, the Subproject Employermust provide instructions to all households with connection needs about the approach and technique of connection to tertiary sewer lines. Procedures and instructions on connection must reach each specific household as they may face difficulties in house renovation, connection fees.	- PMU agreed with People's Committees' on contributed opinions. - PMU will review and assess carefully environmentally sensitive locations/areas and provide prevention and scientific, feasible and reasonable mitigation measures in conformity with local specific conditions. - During implementation, the PMUwill co-operate closely with local authorities to carry out measures to mitigate environmental – social impacts and ensure social security and order.
Opinions of departments and agencies: Department of Natural Resources and Environment: - Agreeingon report contents; - Proposing the Subproject to conform to all legal regulations on the time and place of posting environmental reports and resettlement assistance plans and compensation options. Nha Trang City's Fatherland Front: Agreeing on report contents and agreeing to cooperate with the Subproject in communication tasks and posting of ESIA reports, Subproject policy framework and resettlement assistance and compensation options. Department of Labor, Invalids, and Social Affairs: Agreeingon the report contents. It is necessary to make and forward a list of cases with job changes the Department of Labor, Invalids, and Social Affairs. Department of Finance: Agreeingon the report contents. It is necessary to update new regulations. Land Fund Development Center: Agreeing onthe report contents.	- The PMU agreed on contributed opinions.

7.2.2. Results of First and Second Public Consultation Stage

Table 7-2. Summary of consultation results from 1st and 2nd public consultation

Contents Time/ location	Opinions from local residents	Correspondance by PMU/Consultant
Vinh Ngoc Commune, 1st consultation on23/2/2016 with 45 participants; 2nd consultation meeting on 8/7/2016 with 50 participants	- Participants agreed to support the subprojectguidelines; - The subproject will have positive impacts on residents by solving environmental sanitation problems; - There must be sound and full compensation policy toward affected residents. - Local labor should be employed when the subproject is implemented. - Mitigation measures are to be applied during the construction stage. - There are no endemic species or local species listed in the Red Book which need to be protected. - The affected primary school requests the Subproject to reinstate gate and fence and to make arrangements for classrooms before deploying the subproject. - Compensation for the acquired culture house of Xuan Ngoc hamlet should be made by paying replacement costs.	- Opinions/comments contributed by the local authority and residents will be included in the report for higher subproject implementation. - Compensation: WB always takes local people's living and social security into account to develop the most reasonable policy. - PMU agrees on the above opinions.
Vinh Hai Ward, 1st consultation meeting on 23/2/2016 with 80 participants; 2nd consultation meeting on 11/7/2016 with 76 participants	- The participants support subproject implementation and expect the subproject progress to be speeded up. - Affected residents must be satisfactorily compensated. - The subproject will have positiveimpact on social-economic conditions as well as local environment. - Attention is to be paid to adverse impacts from land acquisition, site clearance, increased traffic, dust and exhaust gases generated during the construction stage. - Mitigation measures should be carried out during the construction stage.	- These issues will be included in the report. - Agree on raised opinions/comments; - Compensation issues: WB always takes local people's living and social security into account to develop the most reasonable policy. - Detailed assessment on environmentally vulnerable sites/areas will be done. Prevention and mitigation measures will be selected scientifically, feasibly and reasonably in conformity with local conditions. - Roles of local communities and authorities in environmental monitoring during the subproject implementation phases will be enhanced.

Contents Time/ location	**Opinions from local residents**	**Correspondance by PMU/Consultant**
Van Thang Ward, 1st consultation meeting on 24/2/2016 with 69 participants; 2nd consultation meeting on6/7/2016 with 70 participants	- Local residents have been adequately informed on the subproject. - Local residents agree to support the Subproject and are waiting for subproject implementation. - The subproject has important role in uplifting the city's image and handling environmental sanitation problems along Cai river. - Due to human activities, the ecosystem is poor and there are no endemic speciesalong the river. - Site clearance will be difficult because households will be affected and relocated, resulting to harder living conditions. - Affected residents wish to be resettled within the ward. - When arranging the site, more land should be allocated to build the ward's public works. - Households' drainage will be impacted during construction. - Dust and noise generation should be mitigated and construction materials should be neatly arranged in order not to affect local transportation/traffic. - Local transportation/travel and security should receive proper attention.	- These raised issues will be included in the report. - Compensation issues: WB always takes local people's living and social security into account to develop the most reasonable policy. - Detailed assessment on environmental vulnerable sites/areas will be done. Prevention and mitigation measures will be selected scientifically, feasibly and reasonably in conformity with local conditions. - The roles of local communities and authorities in environmental monitoring during subproject implementation phases will be enhanced.
Vinh Phuoc Ward 1st consultation meeting on 24/2/2016, 44 participants; 2nd consultation meeting on 6/7/2016, 43 participants	- The Subproject, with the construction of Chu Dong Tu Street and the embankment on the northern bank of Cai River, will help remove flooding problems in the area. - As the local land fund for resettlement is not available, local residents would choose Ngoc Hiep Resettlement Site recommended to the Subproject by the People's Committee of the province.	- WB always takes local people's living and social security into account to develop the most reasonable policy. - The roles of local communities and authorities in environmental monitoring during subproject implementation phases will be enhanced.

Contents Time/ location	**Opinions from local residents**	**Correspondance by PMU/Consultant**
Ngoc Hiep Ward 1st consultation meeting on 25/2/2016, 66 participants 2nd consultation meeting on 6/7/2016, 68 participants	- Local people have been adequately informed on the Subproject. - Local residents agree to support the Subproject and are waiting for efficient implementation. - Difficulties in compensation and clearance site must be forecasted as this is a long-inhabited area and local residents do not wish to be displaced. - Due to human activities, the ecosystem along Cai river is poor with no particular species. - The representativeof Ngoc Thuy Vihara is ready to support the Subproject and conform to Subproject policies, but there must be satisfactory compensation. - Once implemented, the Subproject will generate dust and noise from backfilling and ground leveling operations, affecting traffic and transportation. It will be difficult for large trucks to work in the area. - Construct operations must be avoided during rest andthe site must be watered to reduce dust. - Survey should be done carefully. - Construction operations should be tidily carried out without affecting local people.	- WB always takes local people's living and social security into account to develop the most reasonable policy. - Detailed assessment on environmentally vulnerable sites/areas will be done. Prevention and mitigation measures will be selected scientifically, feasibly and reasonably in local conditions. - Roles of local communities and authorities in environmental observation during the subproject implementation phases will be enhanced.
Vinh Tho Ward 1st consultation meeting on 25/2/2016, 10 participants 2nd consultation meeting on 12/7/2016, 13 participants	- Local authorities and people will support the subproject. Wastewater is a hot issue in Vinh Tho Ward, where business households wish to have a wastewater system connected to their houses. - The subproject should be implemented with a clear-cut time frame and the progress should be speeded up. - Bau Market area is a hotspot, in terms of wastewater pollution. - The subproject will have positive impacts on the improvement of local environmental sanitation. - Construction will cause certain impacts on local people's life from dust and road excavation.	- Local authority's and people's opinions are acknowledged. - Mitigation measures for environmental impacts will be well-done.

Contents Time/ location	**Opinions from local residents**	**Correspondance by PMU/Consultant**
Vinh Hoa Ward 1st consultation meeting on 25/2/2016, with 10 participants 2nd consultation meeting on 5/7/2016, with 12 participants	- Local authority and people will support the subproject and wait for its implementation. - Local people wish that their sewage lines are connected to the city's wastewater system. - Construction should be speeded up, avoiding unnecessary and improper delay. - Construction is likely to cause traffic difficulties, especially in the raining season, with high risk of traffic accidents. - Measures to mitigate noise and dust should be carried out.	- Local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts.
Phuong Son Ward 1st consultation meeting on 27/2/2016, with 11 participants 2nd consultation meeting on 7/7/2016, with 15 participants	- The local authority and people support the implementation of the subproject. - The connection from existing septic tanks from residents' houses to tertiary sewer lines may cause changes in house structures and claim substantial costs. - Owners of new houses currently under construction will be encouraged by the local to connect their houses to tertiary sewer lines. - Schools and governmental agencies will be prioritized for connection to drainage systems. - The subproject should be implemented soon so that residents with sufficient conditions and current needs could have their houses connected to the drainage system.	- The local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts.
Vinh Nguyen Ward 1st consultation meeting on 27/2/2016, with 12 participants 2nd consultation meeting on 8/7/2016, with 16 participants	- Road surfacesshould be promptly reinstated as planned, otherwise delayed reinstatement would cause adverse impacts on locals' living conditions. - The local authority and local people support the Subproject and its development objectives,hope for prompt subproject implementationwhich would help improve local living environment and heighten people's living.	- PMU recorded and acknowledged the comments/opinions from local people and government authority, and will work out reasonable construction plansto mitigate adverse impacts caused by the Subproject.

Contents Time/ location	**Opinions from local residents**	**Correspondance by PMU/Consultant**
Phuoc Tan Ward 1st consultation meeting on 26/2/2016, with 12 participants 2nd consultation meeting on 7/7/2016, with 15 participants	- The local authority and people will support the implementation of the subproject. - Local people wish to have their housesconnected to the wastewater collection system. - The Subproject should take records of the existing status of the residential area and the infrastructure prior to construction as a basis for future compensation in case of damages caused by construction operations. - Subproject implementation may affect local traffic or cause subsidence of residents' houses. - Construction measures should be scientifically devised by using the successive method to reduce impacts on local traffic. - The Subproject is expected to have funds to improve local infrastructure. - The Subproject progress should be speeded up. - Technical design should take into account those households located far from tertiary sewer lines.	- The local authority's and people's comments/opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts.
Loc Tho Ward 1st consultation meeting on 18/2/2016, with 9 participants 2nd consultation meeting on 8/7/2016, with 10 participants	- The local authority and people will support the subproject; the subproject is believed to be environmentally practical. - Impacts on local business as well as traffic should be mitigated during subproject implementation. - A number of hotspots in terms of environment still exist in the ward (Quan Tran – Loc Tho, Tran Phu Street area). - The People's Committee will encourage residents to have their houses connected to the tertiary sewer line network. - Survey and design should be done efficiently carried out to thoroughly solve environmental sanitation problems. - Co-operation among agencies need to beuniform and consistent, with duties clearly assigned to the parties. - Drainage is still slow along some streets, affecting people's livelihood and business (Hoang Hoa Tham Street, Hung Vuong Street, Tran Phu Street.)	- The local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts.. - Site survey and investigation will be performed in such a way that the most effective design could be obtained.

Contents Time/ location	**Opinions from local residents**	**Correspondance by PMU/Consultant**
Phuoc Hoa Ward 1st consultation meeting on 19/2/2016, with 12 participants 2nd consultation meeting on 4/7/2016, with 13 participants	- The local authority and the people will support the subproject. - The subproject is believed to have positive impacts on local social-economic life as well as technical infrastructure. - Construction must be performed carefully to reduce impacts to local traffic, especially in narrow streets with no street boundaries. - Successive construction measures should be neatly applied to avoid impacts on residents. - Assistance loans to poor or near- poor households should be re-considered and granted for these households to have their houses connected to the sewer system.	- The local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts. - Site survey and investigation will be performed in such a way that the most effective design could be obtained. - Close coordination with local government authorities in subproject implementation.
Phuong Sai Ward 1st consultation meeting on 26/2/2016, with 9 participants 2nd consultation meeting on 4/7/2016, with 10 participants	- The local authority and people support the subproject. - The subproject meets local needs. - Sewer line level shouldn't be higher than house floor level. - The subproject is practical to local conditions. - In construction phase, the Subproject needs coordination of local government authority.	- The local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts. - Site survey and investigation will be performed in such a way that the most effective design could be obtained. - Close coordination with local government authorities in subproject implementation.
Van Thanh Ward 1st consultation meeting on 20/2/2016, with 9 participants 2nd consultation meeting on 5/7/2016, with 11	- The local authority and people agree on Subprojectimplementation. - The subproject contributes to environmental protection, environmental sanitation improvement, social – economic improvement in the locality. - Impacts, such as dust, traffic safety, and local people's circulation should be addressed. - Subproject implementation should be speeded up to minimizeimpacts on residents' living conditions.	- The local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts. - Site survey and investigation will be performed in such a way that the most effective design could be obtained.

Contents Time/ location	**Opinions from local residents**	**Correspondance by PMU/Consultant**
participants		- Close coordination with local government authorities in subproject implementation.
Phuoc Long Ward 1st consultation meeting on 19/2/2016, with 11 participants 2nd consultation meeting on 4/7/2016, with 12 participants	- Most streets in the ward are without sewer lines. - Many households want to be connected to sewage lines. - The local authority and people support the subproject as it will have positive impacts on local environmental sanitation. - Sewer construction will cause impact on local streets and traffic. - The subproject construction should be carried out with successive measures. - During construction, there should be measures to mitigate adverse environmental and social-economic impacts on socio-economicconditions in general and local conditions in particular.	- The local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts. - Site survey and investigation will be performed in such a way that the most effective design could be obtained. - Close coordination with local government authorities in subproject implementation.
Tan Lap Ward 1st consultation meeting on 18/2/2016, with 12 participants 2nd consultation meeting on5/7/2016, with 15 participants	- The subproject helps to reduce environmental pollution in the local area. - However, connection to sewer line will require reformation of houses and high fees. Many wish to have their houses connected to the sewer lines but have not received detailed instructions. Subproject Employer should therefore provide locals with detailed information on procedures. - The People's Committee of the Ward will disseminate subproject information to local people. However, the Subproject Employershould provide information on the approach as well as technical matters for proper connection to tertiary sewer systems. - During subproject implementation, several sewer lines may generate bad odors and some places will be flooded. Related units of the Subproject should ensure technicalstandards of construction to avoid flooding in a number of local roads as well as effects on environmental sanitation. - Attention should be paid to creating favorable conditions to enjoy public consensus, meeting technical requirements, and mitigating impacts on the environment.	- The local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts. - Site survey and investigation will be performed in such a way that the most effective design could be obtained. - Close coordination with local government authorities in subproject implementation.

Contents Time/ location	**Opinions from local residents**	**Correspondance by PMU/Consultant**
Xuong Huan Ward 1st consultation meeting on19/2/2016, with 12 participants 2nd consultation meeting on 5/7/2016, with 10 participants	- The local authority and people support the subproject, as the subproject is aimed at improvingthe infrastructure for environmental sanitation, on which basis cultural – social – economic aspects in the locality will be developed. - Only some of the households in the ward have their houses connected to the city's existing sewerage system. Thus, there should be a policy supporting those households who wish to benefit from the city's sewerage system. - There should be consistent and synchronous coordination and information exchange among PMU, the local authority and localpeople.	- The local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts. - Site survey and investigation will be performed in such a way that the most effective design could be obtained. - Close coordination with local government authorities in subproject implementation.
Phuoc Tien Ward 1st consultation meeting on 20/2/2016, with 11 participants 2nd consultation meeting on 11/7/2016, with 15 participants	- The local authority and people support the subproject. - Currently, only some of the streets in the ward are with tertiary sewer lines. - The Subproject is expected to have positive impacts on local environmental sanitation and socio-economic aspects.	- The local authority's and people's opinions are recorded and acknowledged. - The Subproject undertakes to carry out effectively measures to mitigate environmental impacts. - Site survey and investigation will be performed in such a way that the most effective design could be obtained. - Close coordination with local government authorities in subproject implementation.

7.2.3. Responses and Commitments of Subproject Employer

The Subproject Employeragrees on and acknowledges opinions/comments from the People's Committees of Wards/Communes and their local residents. The Subproject Employerand the Consultant have reviewed and incorporated those opinions/comments in the report and finalized the ESIA report on the basis of fully acquiring opinions/comments of the People's Committeesof Wards/Communes and local communities in the subproject area.

The Subproject Employerwill continue to pay attention to the implementation and supervise the Contractor's performance of mitigation measures for environmental impacts adequately and in accordance with the contents in the ESIA report.

The Subproject Employercommits to reasonably handle all issues related to compensation and assistance for local people, according to regulations prescribed by the Vietnamese Government.

7.3. Information disclosure

The draft ESIAhad been published at the offices of Nha Trang City People's Committee and the People's Committees of subproject wards and communes on October 5,2016. Information on the release date was posted on the website of Nha Trang City People's Committee. Basing themselves on the contents of the ESIA, local people could get theSubproject information and contribute their opinions/comments on environmental issues of the Subproject.

The draft ESIA was also sent to the World Bank office in Vietnam for its disclosure on the World Bank's Infoshop on October 6, 2016.

CONCLUSIONS, RECOMMENDATIONS AND COMMITTMENTS

1. Conclusions

The Subproject will contribute to improving drainage conditions, overcoming inundation, bettering the natural environment and hygienic conditions in the areas of Nha Trang city. In the process of urbanization and modernization of the city, the implementation of this Subproject proves to be necessary, thereby contributing to the sustainable development of Khanh Hoa province in general and the city of Nha Trang in particular.

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 a subproject investment license. In addition, this is also an important document helping in subproject appraisal and in the negotiation and signing of the loan agreement between the Government of Vietnam and the World Bank

Environmental impacts:

The ESIA report has identified and assessed the environmental impacts in all phases of the Subproject, as well as environmental risks that may occur during the Subproject phases. However, some impacts are beyond accurate forecastssuch as impacts on climate change, unexpected incidents likely to take place during the construction and operation of the Subproject. The reason of failing to provide accurate forecasts for those impacts can be seen as being objective, as any unforeseen naturalhappening could materialize at any time in the future. Whether some other impacts are at a low, moderate or severe level depends greatly on contractors' performance as well as environmental management and occupational safety, local authorities' management, awareness of the community, etc. Those factors are of no firm grounds for accurate forecasts.

The environmental impacts, during the assessment process, were assessed on the basis of theoretical and experimental formulas, statistical data and experience from similar subprojects. However, no assessment method has been known to be completely accurate, and assessment is relativequantification of the impacts instead. In the process of subproject implementation, there will be appropriate adjustments on the basis of opinions forwarded by the environmental monitoring consultant so as to minimize adverse impacts on the environment.

The beneficial impacts of the Subproject include improvement of environmental sanitation, mitigated inundation, better drainage, and safer traffic conditions for invested areas in Nha Trang city, especially reducing negative impacts from wastewater. Treated wastewater meeting environmental standards before being discharged into the receiving waterswill help pollution levelsof surface water sources of Cai river.

Most of the impacts during the pre-construction and construction stagesare temporary and short-term, taking place in areas around construction sites or on transport routes and at disposal sites. In the construction phase, several impacts related to dust, noise,social security, or occupational safety are much likely to arise. However, these can be limited or mitigated to 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. Nevertheless, these impacts are short-term and mild.

Negative impacts arising in the operation stage of the wastewater treatment plantswill be of a potential and lasting nature. Therefore, the Owner is to carry out all mitigation measures for negative impacts mentioned in this report to comply with Vietnamese environmental standards.

Mitigation measures:

Measures to control pollution and limit adverse impacts on environment in the construction and operation phases proposed and recommended in this report prove to be feasible and able to meet Vietnamese environmental standards.

A common feature shared by all proposed mitigation measures is attention to be paid to communication and education for betterconsciousness and awareness among local communities, coupled with managerial and technical measures, with the prevention of environmental issues that might occur and with the plans for addressing arising environmental problems. These measures are feasible and highly effective, and have been proven successfulin many similar subprojects.

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 – the donor. These data will also serve the evaluation of the effectiveness and environmental sustainability of the Subproject.

On the basis of the characteristics of the current environmental status and the forecasts of pollution level, the Subproject' measures to prevent and mitigate the impactsare established in conformity with general conditions and each particular case. In order to ensure uniform environmental protection, an environmental management system is set up from subproject establishment until the operation of the Subproject. The environmental management system will ensure the management, monitoring, reporting, preparation and adjustment of measures to minimize environmental pollution during subproject implementation. Environmental monitoring will be regularly carried out in accordance with the Environmental Protection Law and the guidelines of the State.

The Subproject has been communicated to local people and local authorities in the subproject area. The Subproject has also received support and valuable constructive opinions from local people and local authorities.

2. Recommendations

This is an environmentally significant subproject, aiming at future sustainable development, and also one of the prerequisites of socio-economic development in Khanh Hoa province in general and Nha Trang city in particular. Therefore, the Owner would like to propose for DONRE's appraisal and approval of the ESIA report of the Subproject as well as WB's approval for timely and prompt deployment of the subproject.

In the process of subproject implementation, the PMU would propose relevant departments andlocal administrative agencies to participate in environmental protection throughout subproject implementation from the preparation to operation stage of the Subproject.

During the implementation of the Subproject, the PMU would seek the coordination as well as support and constructive comments from MONRE, Khanh Hoa province's DONRE, and the Department of Environment and Resources of Nha Trang city to carry out environmental protection efficiently.

3. Commitments

During the operation of the Subproject, the Ownercommits 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 towardsthe 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 Subproject,and taking steps of environmental recovery in accordance with to legal regulations on environmental protection when subproject operation has been completed.

APPENDICES

Appendix1. Assessment on material quarries' compliance with health and environment safeguard

Appendix2. Assessing the environmental compliance of luong hoa landfill

Appendix3. Due diligence review EIA – Hon Ro and Ngoc Hiep resettlement sites

Appendix4. Diagram of sampling positions

Appendix 5- CCSEP Nha Trang Dredged Materials Management Plan

APPENDIX 1. Assessment on Compliance of Material quarrieswith Health and Environment Safeguard

1. Southern Hon Ngang Quarry

No.	Main content	Description
1	General information	Address: Dien Son Commune, Dien Khanh district, Khanh Hoa Province. Access road from Nha Trang City:23/10 Road, through National Highway 1A to the quarry. Mining company: Khanh Hoa Transportation Equipment and Material JSC. Total area: 20 ha Capacity: 200,000m^3/ year Permitted mining depth: from elevation +135 to elevation +30 Legal permits and licensesissued by the Government of Vietnam (GoV): - Mining Licence No. 5681/QD-UN dated 5 February 1997 by Khanh Hoa People's Committee (PPC).Licence validity is 30 years. - Blasting Licence No.543/GP-SCT dated 30 October 2015 by Khanh Hoa Industry and Trade Department. - Decision on EIA report approval No. 763/QD-UB dated 03 December 1997 by the Chairman of Khanh Hoa PPC. - Other documents such as Security Certificate No. 54/GCN by Khanh Hoa Provincial Police andFire Prevention and Firefighting Certificate No. 49/DK-PCCC Technological process of mining: Removal of cover layer – Drilling and blasting – Piling - Stone transportation to crushing and screening complex – Classificationof finished stone –Customers' means of transport.
2	Main environmental issues	Dust: Generated from drilling, blasting, piling, transportation, processing. Noise: Generated from activities of crushing and screening complex and transportation trucks. Blasting safety: dust, noise, vibration, stone Labour safety: possibly occurring due to incompliance with technical and labour safety procedures. Distance to residential area: at least 800m Trees: planted adequately in the mining area Domestic waste: generated from daily acitivites of workers
	Main equipment/ machine	Types: 02 hand-held drillers, 02 BMK5 drillers, 03 excavators of 1.2m^3/bucket, 03 diggersof finished stone; 04 12-ton trucks for stone transportation, 03 crushing and screening complexes with capacity of 75 tons/hour, 02 air compressors.
3	Pollution control measures	Dust: - Installing 03 tanks for water spraying, 03 pumping motors (2Hp and 4Hp types) at 03 crushing and screening complexes and 01 water reservoir with volume of 4,500m^3. - Planting 3,000 acacias at the processing area and 200 acacias at the office area. - Investing a 3m^3 water tanker (handmade truck) for watering to eliminate dust along transportation roads. Noise: frequently maintaining engines of crushing and screening complexes and truck engines to reduce noise. Blasting safety: - Blasting Licence No.543/GP-SCT dated 30 October 2015 by Khanh HoaIndustry and Trade Department. - Using allowable explosives - Blasting by electric milisecond delay detonator method - Labour Safety: - Disclosinglabour safety regulations and equipment operation processeson site.

		- Fully equipping labour protection tools such as: protection clothing, hemets, gloves, masks, etc. - Workers directly operating construction machines must be trained and practicethe operation properly in case of incidents likely occuring and must always be present at their working places for technically proper operation and inspection. Domestic waste: Re-using old barrels of 200 litres/barrel to store domestic waste daily generated by workers for later collection and transportation by Dien Khanh Urban Public Work ServiceCompany for disposal. Monitoring activities: Quarterly measuring and monitoring the environmental quality of the quarry and submitting reports to the Department of Natural Resources and Environment (DONRE) for monitoring. Besides, there is the people's participation in monitoring. In case of any complaints or grievances regarding illegal activities of the quarry, such complaints and grievances will be submitted to monitoring groups. Then, the local authority will come to check and inform the quarry managers who are responsible for dealing with community concerns. If settlement by the quarry manager is not satisfactory, the local authority will report to DONRE. Upon receipt of such complaints, DONRE will organize an inspection to identify cases and propose measures how and by when remedy to be taken the quarry owner. Otherwise, quarry operation will be suspended or closed.
4	Hazardous waste	Volume: 400 litres of oil for engines, gear boxes and lubrication per year (Code: 17 02 03) Collection and treatment unit: re-use for machine lubrication
5	Depositat Environmental Protection Fund	Annual deposited amount: 214,023,000 VND completed prior to 31 January. Implementation option/responsibility: As per the cost estimation for environmental recovery dated 12 August 2003, which was approved by Khanh Hoa Department of Science, Technology and Environment. The deposit transmittancewill be monitored by the Environmental Protection Fund. By the due deadline, if the deposit transmittance is not made, a reminder will be sent by the Fund to quarry owner. If the deposittransmittanceis resisted by the quarry owner, the Fund will send a letter recommending DORNE on a respective sanction as regulated.
6	Stone and mineblasting safety	Licensing authority: Khanh Hoa Industry and Trade Department. Informationdisclosure method for communities: - Setting up boundary warning signs at blasting area - Informing blasting signals: siren blasts + Charging explosives: 4 long siren blasts + Preparing for blasting: 3 long siren blasts + Blasting: 2 long siren blasts + All-clear signal: 1 long siren blast - Blasting time: + Morning: 11h00 - 12h00 + Afternoon: 17h00 - 18h00
7	Labor safety	Number of workers: 30 persons Quantity of / cost for labour protection: 80 pairs of protection clothing, 46 pairs of plastic boots, 30 yellow plastic hemets, 38 pairsof linen gloves, 112 masks, 11 gas masks, 34 noise prevention buttons, 30 raincoats. Total cost: 19,665,600 VND. Periodicalmedical checkup: Once a year at Preventation Health Centre of Khanh Hoa Province. Periodical labour safety training: twice a year. Trainer: Labour Sanitation and Safety Board of the Company HIV/AIDS awareness enhancement: once a year, propogated with periodical medical checkup. Facilities: Fully equippedtoilets and dining rooms

<table>
<tr><td rowspan="3">8</td><td rowspan="3">Some photos of quarry area</td><td> 
Trees in the quarry</td><td> 
Watering to reduce dust at screening process</td></tr>
<tr><td> 
Water pond in the quarry for watering to reduce dust on site</td><td> 
Stone quarry</td></tr>
<tr><td> 
Workers' watering to reduce dust on site</td><td> 
Trucks washed on site</td></tr>
</table>

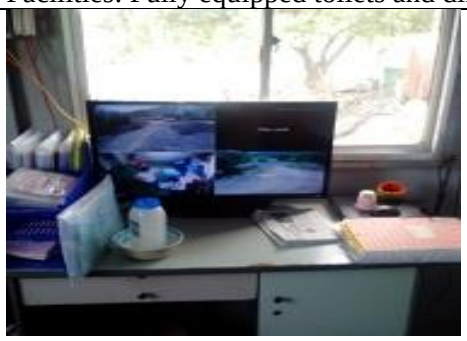
According to periodic monitoring report of Southern Hon Ngang Quarry, Periodic analysis results of air quality (every three months) monitored Nha Trang Pasteur institute show that the parameters Noise, Dust, SO2, NO2, CO are within allowable limits according to QCVN 05:2013/BTNMT – National technical regultion on ambient air quality, QCVN 06:2009/BTNMT – National technical regulation on hazadous subtances in ambient air, QCVN 26:2010/BTNMT – National technical regulation on noise.

Conclusion: The mining activities of Khanh Hoa Transportation Equipment and Material JSC. at Southern Hon Ngang Quarry have complied the legal regulations of the GoV in mining, preparation of environmental documents, and implementation of mitigation methods as proposed in the report. Meanwhile, the Company has completed a deposit transmittanceat the Environmental Protection Fund as stipulated.

2. Western Hon Ngang Quarry

No.	Main content	Description
1	General Information	Address: Dien Lam Commune, Dien Khanh district, Khanh Hoa Province. Acess road from Nha Trang City: 23/10 Road , through National Highway 1A to the quarry. Mining company: Khanh Hoa Transportation Construction and Management JSC. Total mining area: 3.6 ha Mining capacity: 43,480m^3/ year Mining depth: from elevation +100 to elevation +25 Legaldocuments allowed by the GoV: - Mining Licence No. 3511/QD-UN dated 31 December 2013.

		- Decision on EIA report approval No. 2346/QD-UBND dated 24 September 2013 bythe Chairman of Khanh Hoa PPC. - Blasting Licence No.60/GP-SCT dated 12 February 2014 by Khanh Hoa Industry and Trade Department. Technological process of mining: Removal of cover layer – Drilling and blasting – Piling - Stone transportation to crushing and screening complex – Classificationof finished stone –Customers' means of transport
2	Main environmental issues	Dust: Generated from drilling, blasting, piling, transportation, processing. Noise: Generated from activities of crushing and screening complexes and transportation trucks. Blasting safety: dust, noise, vibration, stone Labour safety: possibly occurring due to incompliance with technical and labour safety procedures. Distance to residential area: at least2km Trees: planted adequately in the mining area Solid waste: generated from the removal of cover layer Domestic waste: generated from daily acitivites of workers
	Main equipment/ machine	Types: 02 BMK5 drillers, 02 excavators of 1.0m^3/bucket, 02 shovel tractors of finished stone; 02 12-ton trucks for stone transportation, 01 crushing and screening complex with capacity of 100 tons/hour, 02 air compressors.
3	Pollution control measures	<u>Dust:</u> - Installing05 tanks for water spraying, 01pumping motor (2Hp type) at the crushing and screening complex and 01 water reservoir with volume of 2,000m^3. - Investing a4m^3water tanker (handmade truck) for watering to eliminate dust along transportation roads. <u>Noise</u>: frequently maintainingthe engines of the crushing and screening complex and truck engines to reduce noise. <u>Blasting safety</u>: - Blasting Licence No.60/GP-SCT dated 12 February 2014by Khanh Hoa Industry and Trade Department. - Using allowable explosives - Blasting by electric milisecond delay detonator method <u>Labour Safety</u>: - Disclosing labour safety regulations at working office. - Fully equipping labour protection tools such as: protection clothing, hemets, gloves, masks, etc. - Workers directly operating construction machines must be trained and practicethe operation properly in case of incidents likely occuring and must always be present at their working places for technically proper operation and inspection. <u>Solid waste:</u>Using the disposal site on an area of about 4,000 m^2 to store the removed covering soil. <u>Domestic waste</u>: Installing 02 dustbins with volume of 100 litres each to store domestic waste daily generated by workers for later collection and transportation to the local disposal site. <u>Environmental monitoring activities</u>: Quarterly measuring and monitoring the environmental quality of the quarry and submitting reports to the Department of Natural Resources and Environment (DONRE) for monitoring.
4	Hazardous waste	Volume: 100 litres of grease for engines, gear boxes and combined lubrication per year. Collection and treatment unit: re-use for machine lubrication of the crushing and screening complex.

<table>
<tr><td>5</td><td>Depositat Environmental Protection Fund</td><td colspan="2">Duration: 22 years
Annual deposited amount: 1,514,762,580 VND, completed prior to 31 January.
Implementation option/responsibility: As per the cost estimation for environmental recoveryunder the Stone Mining and Processing Investment Project at Western Hon Ngang Quarry approved by Khanh Hoa PPC pursuant to the Decision No. 2347/QD-UBND dated 24 September 2013.
The deposit transmittancewill be monitored by the Environmental Protection Fund. By the due deadline, if the deposit transmittance is not made, a reminder will be sent by the Fund to quarry owner. If the deposit transmittance is resisted by the quarry owner, the Fund will send a letter recommending DORNE on a respective sanction as regulated.</td></tr>
<tr><td>6</td><td>Stone and mineblasting safety</td><td colspan="2">Licensing authority: Khanh Hoa Industry and Trade Department.
Information method for communities:
- Setting boundary signs at blasting area
- Informing blasting signals: red flags, bells, loudspeakers
+ Setting red flags at the top: Preparing for charging explosives
+ Preparing for blasting: 3 siren blasts
+ Blasting: 2 long siren blasts
+ All-clear signal: 1 long siren blast</td></tr>
<tr><td>7</td><td>Labor safety</td><td colspan="2">Number of workers: 16persons
Quantity of / cost for labour protection: 40 pairs of protection clothing, 40 pairs of garmentshoes, 40 fabric hats,25 yellow plastic hemets, 300 pairsof linen gloves, 30 masks, 40 white glasses,20 welding masks, 23 noise prevention buttons. Total cost: 27,476,000 VND.
Periodicalmedical checkup: Once a year at Preventation Health Centre of Khanh Hoa Province.
Periodical labour safety training: twice a year.
Trainer: Labour Sanitation and Safety Board of the Company
Facilities: Fully equipped toilets and dining rooms</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Some photos of quarry area</td><td> 
Internal monitoring system</td><td> 
Trees around the quarry</td></tr>
<tr><td> 
Crushing and screening process. Watering will be provided to reduce dust at the beginning of this process.</td><td> 
Water reservoir for watering to reduce dust.</td></tr>
</table>

Periodic analysis results of air quality (every three months) monitored by Environmental monitoring center – Khanh Hoa DONRE show that the parameters Dust, SO2, NO2, Hidrocacbon are within allowable limits according to QCVN 05:2013/BTNMT – National technical regultion on ambient air quality, QCVN 06:2009/BTNMT – National technical regulation on hazadous subtances in ambient air. Some times, the noise level exceeding insignificantly the allowable limits according to QCVN 26:2010/BTNMT – National technical regulation on noise.

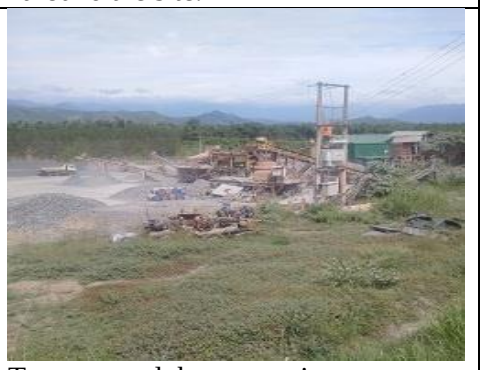
Analysis results of groundwater quality of Western Hon Ngang quarry monitored by Environmental monitoring center – Khanh Hoa DONRE show that most of parameters (expect Coliforms) are within allowable limits according to QCVN 09-MT:2015/BTNMT- National technical regulation on groundwater quality.

Conclusion: Due diligence conducted by the consultant found that the mining activities of Khanh Hoa Transportation Construction and Management JSC. in Western Hon Ngang Quarry have complied the legal regulations of the GoV in mining, preparation of environmental documents and implementation of mitigation methods as proposed in the report. Meanwhile, the Company has completed a deposit transmittance at the Environmental Protection Fund as stipulated.

3. Western Hon Ngang Quarry – An Phong Road and Bridge Exploitation JSC.

No.	Main content	Description
1	General Information	Address: Dien Lam Commune, Dien Khanh, Khanh Hoa Province. Access road from Nha Trang City: Road 23/10, through National Road 1A to the quarry. Mining company: An Phong Road and Bridge Exploitation JSC. Starting time: In 2011.Mining time: 17.5 years. Total mining area: 5 ha Mining capacity: 100,000m^3/year Mining depth: from elevation +120 to elevation +20 Legaldocuments allowed by the GoV: - Mining Licence No. 1926/GP-UBND dated 9 August 2013. - Blasting Licence No.37/GP-UBND dated 27 August 2013 by Khanh Hoa Industry and Trade Department. Technological process of mining: Removal of cover layer – Drilling and blasting – Piling - Stone transportation to crushing and screening complex – Classificationof finished stone –Customers' means of transport.
2	Main environmental issues	Dust: Generated from drilling, blasting, piling, transportation, processing. Noise: Generated from activities of crushing and screening complexes and transportation trucks. Blasting safety: dust, noise, vibration, stone Labour safety: possibly occurring due to incompliance with technical and labour safety procedures. Distance to residential area: at least300m Trees: planted adequately in the mining area Solid waste: generated from the removal of cover layer Domestic waste: generated from daily acitivites of workers
	Main equipment/ machine	Types: 02 hand-held drillers, 05 BMK5 drillers, 02 excavators of 1.2m^3/bucket, 01 shovel tractor of finished stone; 02 12-ton trucks for stone transportation, 01 crushing and screening complex with capacity of 150 tons/hour, 01 COBECO air compressors.
3	Pollution control measures	<u>Dust:</u> - Installing05 tanks for water spraying, 01pumping motor (5Hp type) at the crushing and screening complex and 01 water tanker with volume of3,500m^3. - Planting 1,000 acacias at the processing area. - Investing in a 3m^3water tanker (handmade truck) for watering to eliminate dust along transportation roads. <u>Blasting safety</u>:

		- Blasting Licence No.37/GP-UBND dated 27 August 2013 by Khanh Hoa Industry and Trade Department. - Using allowable explosives - Blasting by latest electric milisecond delay detonator method. Labour Safety: - Disclosing labour safety regulations at the working office. - Fully equipping labour protection tools such as: protection clothing, hemets, gloves, masks, etc. - Workers directly operating construction machines must be trained and practicethe operation properly in case of incidents likely occuring and must always be present at their working places for technically proper operation and inspection. Solid waste:Arranging the disposal site on an area of about 1,000 m^2 to store the discharged oil during the removal of the cover layer. Crushed stone is made use of to make bricks (single and double brick blocks) Domestic waste: Installing 02 dustbins with volume of 200 litres each to store domestic waste daily generated by workers for later collection and transportation to the local disposal site in Go San hamlet – Dien Lam commune – Dien Khanh district – Khanh Hoa. Monitoring activities: Quarterly measuring and monitoring the environmental quality of the quarry and submitting reports to the Department of Natural Resources and Environment (DONRE)andDien Khanh District People's Committee for monitoring.
4	Hazardous waste	Volume: 300 litres of grease for engines, gear boxes and combined lubrication per year (Code: 17 02 03) Collection and treatment unit: re-use for machine lubrication at the crushing and screening complex.
5	Depositat Environmental Protection Fund	Duration: 14 years Annual deposit amount: 2,521,346,777 VND, completed prior to 31 January. Implementation option/responsibility: According to the Environmental Restorationand Improvement Proposal under the Western Hon Ngang Quarry Capacity Upgrading and Extension Investment Project approved by the Chairman of Khanh Hoa PPC pursuant to the Decision No. 1926/GP-UBND by Khanh Hoa PPC.
6	Stone and mineblasting safety	Licensing authority: Khanh Hoa Industry and Trade Department. Information method for communities: - Setting boundary signs at blasting area - Informing blasting signals: red flags, sirens + Setting red flags at the top: Preparing for charging mines + Preparing for blasting: 3 siren blasts + Blasting: 2 long siren blasts + All-clear signal: 1 long siren blast - Blasting time: + Morning: 11h00 - 13h30 + Afternoon: 16h00 - 17h30
7	Labor safety	Number of workers: 20persons Quantity of / cost for labour protection: 40 pairs of protection clothing, 40 pairs of bata shoes, 40 fabric hats,20 yellow plastic hemets, 60 pairsof linen gloves, 90 masks, 20 white glasses,10 welding masks, 20 noise prevention buttons. Periodicalmedical checkup:Once a year at Preventation Health Centre of Khanh Hoa Province. Periodical labour safety training: twice a year. Trainer: Labour Sanitation and Safety Board of the Company Facilities: Fully constructed toilets and dining rooms

8	Some photos of quarry area	 Brick workshop reusingcrushed stone from the stone processing.	 Water reservoir to reduce dust, trees around the site.
		 Stone crushing and screening	 Trees around the processing area

Periodic analysis results of air quality (every three months) monitored by Environmental monitoring center – Khanh Hoa DONRE show that the parameters Noise, Vibration, Dust, SO2, NO2, Hidrocacbon are within allowable limits according to QCVN 05:2013/BTNMT – National technical regultion on ambient air quality, QCVN 26:2010/BTNMT – National technical regulation on noise, QCVN 27:2010/BTNMT – National technical regulation on Vibration.

Analysis results of groundwater quality of Western Hon Ngang quarry monitored by Environmental monitoring center – Khanh Hoa DONRE show that most of parameters (expect Coliforms) are within allowable limits according to QCVN 09-MT:2015/BTNMT- National technical regulation on groundwater quality.

Conclusion: Due diligence conducted by the consultant found that the mining activities of An Phong Road and Bridge Exploitation JSC. in Western Hon Ngang Quarry have complied the legal regulations of the GoV in mining, preparation of environmental documents and implementation of mitigation methods as proposed in the report. Meanwhile, the Company has completed a deposite transmittance at the Environmental Protection Fund as stipulated.

Above is the assessment on the compliance with health and environment safeguard of the locality. During the subproject implementation, if other quarries are used, it is neccessary to implement additional assessment on compliance of such quarriesin respect of health and environmental safeguard issues.

APPENDIX 2. Assessing The Environmental Compliance of Luong Hoa Landfill

The project of Luong Hoa Landfill was executed during 2006-2014 in the CCESP – Nha Trang Sub-Project funded by WB. The preparation of this subproject has complied with WB's environmental and social safeguard policies and with Vietnamese laws. The subproject's EIA report has also been approved by the People's Committee of Khanh Hoa Province. The landfill was put into operation in 2014. The construction of works and the measures of environmental protection serving the operation stage of the item of "Luong Hoa Landfill and Leachate Treatment Station under the CCESP" was certified by the Department of Natural Resources & Environment in Official Dispatch No. 1506/STNMT-CCBVMT dated July 03, 2015.

During operation, the unit operating has also fully complied with the following measures of environmental sanitation:

Landfill operation: designed capacity of 3.3 million tons; area of 12.8ha; projected operational life: 12-21 years; average daily reception of about 350 tons of waste and up to 700 tons at peak times; operational process: daily reception of waste → spraying Bio-SL2100CVH → Leveling → Compacting → Daily backfilling → Spraying chemical insecticides at dumping site, weighting station, vehicle-wash area, garage → Daily washing of roads → Closing up full squares → Controlling leachate → Observation well.

Leachate treatment works: designed capacity: 186 m^3/day; operational process: leachate from Luong Hoa Landfill and Ru Ri Landfill collected into balancing reservoir → Lime slurry reactor tank → Lime settling tank → Nitrogen removal tower (Stripping 1) → Nitrogen removal tower (Stripping 2) → Flocculation-settling tank 1 → SBR tank → Flocculation-settling tank 2 → Discharge tank → Pumping to WWTP to the south of Nha Trang City; sludge → Sludge digester → Luong Hoa solid waste treatment site.

The operating unit also measures the leachate quality before and after being treated by the Station on daily basis for basic indicators such as pH and DO, and take periodic measurements of wastewater for indicators as prescribed in Decision No. 824/QĐ-UBND dated April 07, 2014 by the People's Committee of Khanh Hoa Province providing for the standards of wastewater discharged into the general wastewater treatment system of Nha Trang City. Reports are sent to the Department of Natural Resources & Environment every 3 months. The quality of leachate after treatment has been assessed to meet the standards of wastewater to be discharged into the general wastewater treatment system of Nha Trang City. The operating unit has also kept a logbook to record the operations of treating leachate, including the costs of electricity, chemicals, materials and fuel, and abnormal incidents. This logbook is to be produced to competent agencies at request.

As Luong Hoa Landfill is located in a hilly area, quite far from residential areas (about 1km), local inhabitants are not affected by bad odors. Additionally, groundwater in the area is in a safely separate layer at a depth of 30m. Besides, the landfill is designed in accordance with technical requirements with a layer of clay, a layer of geotextiles, and a waterproof HDPE layer to prevent leachate from penetrating into the soil and polluting groundwater.

Proper measures have been taken to ensure that Luong Hoa Landfill is operated continuously, in conformity with designed processes, and with the expected efficiency of a leachate treatment system and landfill process. The operation of the landfill has not caused any pollution to the environment.

Periodic analysis results of effluent quality at leachate treatment station (every three months) monitored by Environmental monitoring center – Khanh Hoa DONRE show that the parameters pH, COD, BOD5, TSS and T-N are within allowable limits according to QCVN 25:2009/BTNMT – National technical regultion on wastewater of solid landfill.

Analysis results of air quality show that Noise, Dust, SO2, NO2, HC, CO, NH3 and H2S are within allowable limits according to QCVN 05:2013/BTNMT - National technical regulation on ambient air quality, QCVN 06:2009/BTNMT – National technical regulation on hazadous subtances in ambient air, and QCVN 26:2010/BTNMT – National technical regulation on noise.

Photos of Luong Hoa Landfill:

	
Luong Hoa Landfill	Leachate treatment station

APPENDIX 3. Due Diligence Review EIA – Hon Ro and Ngoc Hiep Resettlement Sites

Due diligence review EIA – Hon Ro and Ngoc Hiep resettlement sites

EIAs for the Ngoc Hiep and Hon Ro 2 resettlement sites have been prepared by the Centre for Environmental Monitoring of Khanh Hoa province. The EIA for the Hon Ro 2 was approved by Khanh Hoa PPC at Decision No. 2793/QD-UBND dated 11 june 2012 and the EIA for the Ngoc Hiep was approved by Khanh Hoa PPC at Decision No. 746/QD-UBND dated 25 March 2016. The key findings from due diligence review of the two EIAs are presented below.

Hon Ro Resettlement Site

The Hon Ro 2 Resettlement Site is located in Phuoc Dong Commune which is about 5 km from city centre. The site has total land area of 29.4 ha, is bordered with the Tac river to the north, with Hon Ro mountain to the south, with the existing Hon Ro 1 residential area to the east, and with schools and training center to the east. Roads, water supply and power supply, drainage and sewers etc. will be built at this site to accommodate the 6600 residents or 1318 households. The total costs of land acquisition, site clearance and construction of basic infrastructure is 173 billions VND (Approximately 7.8 million US$)

Levelling and construction of the mentioned basic infrastructure has been on-going and expected to be completed by Q IV 2016.

Hon Ro 2 resettlement area is in the process of completing infrastructures

Tests results shows that air and water in the area are generally in good quality. At pre-construction phase, there are 8.72 ha of eucalyptus gardens, 4 ha of garden land and 1 ha of pond at the site. The trees are sparsely distributed and there are no known rare or endangered species to be present in the area. There are 335 households living mostly in temporary/one storey houses at site. Their main sources of incomes are from aquaculture and small household-scale businesses.

As the resettlement site is located at the foot of the Hon Ro mountain, rainwater from mountain slopes follows natural creeks and streams then partly follows the drainages under Nguyen Tat Thanh road to the river or overflows to the south.

With regards to land acquisition and site clearance, 336 households will be affected among which 242 households has been relocated. 29.36 ha of lands have been acquired, in which includes agricultural land (19.56ha), residential land (0.9ha) and other land (9ha). 35 graves will also be relocated. The other predicted potential impacts of land acquisition and site clearance are job and income losses, disturbance or disruption to the daily domestic and business activities, generation of 5,330 tonnes of solid waste from site clearance, dusts generation etc. During site clearance, there will also safety risk during site clearance due to unexploded ordinances that may be left from the war.

To manage the potential impacts of land acquisition and site clearance, Khanh Hoa PPC set a budget at 70.5 billions VND to support the affected households. Among these, 890 million VND has been used for mine clearance to be carried out by Center for Unexploded and mine clearance – Military zone 5. Households affected with land acquisition are either compensated with land or cash, and those affected by demolition of existing structures are compensated with cash which is enough for rebuild equivalent new one. By 3/2016, most of the affected households have received compensation. Payment for households affected with grave relocation will cover the costs of grave relocation, reconstruction and worshipping (5 millions per grave). Those affected households would relocate the graves to pagodas by themself. It is expected to complete in 2011

The key potential impacts during construction phase identified in the EIA includes: i) loss of trees and vegetation cover which may lead to increased erosion and land slide risk, particularly landslide from the mountain; ii) disturbance to the existing drainage pattern which may cause localised flooding in the area;

iii) river water pollution river due to oil and grease, soils, wastes, micro bacteria etc. follows surface runoff from the resettlement site to the Tac and Quan Truong rivers; iv) dusts and gas emission from the construction plans, increased noise and vibration levels; v) generation of approximately 15 m3/d of domestic wastewater and up to 120 kg of domestic solid waste from workers' camps; vi) traffic disturbance and increased accident risks etc.; vii) social disturbance when the workers from other localities come to work and live in the areas; and viii) safety risks for the public and the workers during construction phase;

Most of these impacts are localised, short-term, at low to moderate level thus manageable through commonly known measures to be implemented as part of construction practices: water dusty roads, cover the trucks, install signboards and fences, apply speed limits of vehicles and arrange people to direct/divert traffic, provide adequate accommodation including water supply and sanitation facilities at the camps for the workers to use, provide protective cloths for the workers and first aid kits at the site office, install traps to prevent materials from falling to people on the ground, hire URENCO to collect the construction and domestic wastes, store materials and fuels away from residential houses etc. The contractors will also be required to build coffer dam to prevent solids from entering the Tac river. Non-incinerated bricks will be used for construction in accordance with PM's decision 567 dated 28 November 2011.

Social impacts will be managed by minimising disturbed areas, not to use the land outside the project boundary without agreement from local community and authorities, rehabilitated disturbed areas after construction is completed, apply codes of conducts to the workers such as forbidden of gambling, drinking, drug usage, involve in prostitutions or other actions that cause harm to local security.

On the other hand, the lost of trees and vegetation cover will be compensated by the 4.2% green space as specified in the site's land use plan. Land slide risk, the key challenge of the site during both construction and operation phase, has been fully addressed by engineering solutions described below.

Landslide risks from mountain will be addressed with stepped slopes, 5 m high at each step, and with vertical and horizontal concrete drains. Drainage canals and retaining walls will be built at the bottom and along the entire length slope foots. Collectors and energy dispersion structures will be built along the existing natural streams.

The other potential social and environmental impacts and issues during operation phase of the resettlement site have been considered carefully since the planning stage. For example, land use plan of the resettlement site reserves 71% for residential houses, 8.8% for schools and 4.2% for parks/green space. No open-air market will be built but detail plan included a commercial area.

Wastewater primarily treated in septic tanks will be led to the intake of the pumping station (capacity 1,100 m3/d) located at the northwest of the site. From the PS, wastewater is pumped into a tank where sedimentation and anaerobic treatment processes will reduce 56% of TSS and 15-20% of BOD, COD. Then wastewater is led to the oxidation ditch with 24 hours detention for further removal of BOD and partial removal of N and other organic matters. From oxidation ditch, wastewater will flow into the second sedimentation tank, then to 2 shallow detention pond for removal of bacteria, NH3 and N removal. Treated wastewater will either be used for tree watering or discharged into the Tac river. (page 121-122).

The estimated 6.6 tones of solid waste to be generated each day at the resettlement site will be collected and transported to the city's disposal site. Households will place the waste bags in front of their houses for daily collection by URENCO workers with hand push carts. In public areas, garbage bins with lids placed at every 100 m along the streets and URENCO will collect regularly. Two waste transfer stations, 100 m^2 each, will be built at the northwest and southwest of the site.

An acceptable plan to regularly monitor and supervise to ensure environmental compliance at the construction sites.

In conclusion, the EIA for the Hon Ro 2 Resettlement Site meets the requirements of Vietnamese legislations and WB's safeguard policies

Ngoc Hiep Resettlement Site

The Ngoc Hiep resettlement site has total land area of 14.36 ha, located in Ngoc Hiep ward of Nha Trang City. Currently, agricultural land is dominant at the site but there are also existing schools,a pagoda and grave yards with large number of tombs. The site is surrounded by existing residential groups No. 3 to 9 of Ngoc Hiep ward.

The resettlement project's proposed investments include land acquisition and site clearance, construction of basic infrastructure including roads, drainage and sewers, water and power supply, street lighting and tree planting.

Some photos of current resettlement area Ngoc Hiep

Tests results show that air quality in the area is generally good; however, noise level exceeded standard as the measurement took place at peak hour near the main road. Surface water in Kim Bong river has been polluted with BOD, COD, and P exceed standard 4 times, (NH^3 exceed standard 30 times) due to waste wastewater being discharged into the river. Groundwater has high permanganate concentration and may have negative health effects if groundwater is used for drinking. However, local households in the area have access to piped water supply and groundwater has been used for garden watering only. There are no known floral or fauna species of high biological or economic values in the area.

With regards to land acquisition, 14.36 ha of land will be acquired in which 2 ha is residential land, 9.2 ha is long-term garden land and the rest are roads, water bodies. 149 households will be affected among which 54 households will be relocated. 1144 graves will also be relocated to another places i) Rebury at 02 pagodas (Dao Vien and Kim Son) near the area ii) Rebury at Cemetery of Vinh Thai commune and iii) some people are reburied by themself. (Currently, there were 02 graves had been relocated and reburied by people. Those people would be received the compensation cash after that)

To manage the potential impacts during pre-construction phase, land acquisition will be carried at two stages. In the first phase, payments shall be made to the affected households in parallel with levelling the middle part of the area which is currently mostly abandoned agricultural land, then build basic infrastructure in that part. In the second phase, move the affected households into the resettlement area where infrastructure has been built, then do the levelling and construction of infrastructure in the remaining part of the site. Khanh Hoa PPC set a budget 58.8 billion VND to support the affected households. Among these, 395.3 million VND will be used for mine clearance to be carried out by Center for Unexploded and mine clearance - Military zone 5. Payment for households affected with grave relocation will cover the costs of grave relocation, reconstruction and worshipping (4 millions per soil grave and 6 millions per .constructed grave)

The key potential impacts during construction phase identified in the EIA includes: i) dusts and gas emission from levelling and excavation, transportation of excavated/filling materials; ii) loss of trees and vegetation cover; iii) vibration from construction plants including compactor, iv) generation of 5 m^3 of wastewater and 120 kg of solid waste each day from workers camp, approximately 24,400 m^3 excavated materials and 2,500 tonnes of waste generated from demolition of existing structures; v) increased flooding risks to existing houses and the pagoda due to levelling the ground in the surrounding area; vi) increased pollutant contents in Kim Bong river due to oil and grease, soils, wastes, micro bacteria etc. enters surface runoff from the resettlement site; vii) damages or disruptions to existing infrastructure and related services such as local roads, drainage, power cables etc.; viii) traffic disturbance and increased traffic safety risks; and viii) safety risks for the public and the workers during construction phase;

The existing Luong Dinh Cua secondary school and the Pho Te Ni Tu will not be affected by land acquisition but will be affected with dust, noise, increased flooding risks, reduced visuality, values landscape and accessibility during construction and operation phases. The area around the Ngoc Hiep market will also be affected with increased traffic jams and safety risks.

Most of the construction impacts are localised, short-term, at low to moderate level thus manageable through commonly known measures to be implemented as part of construction practices: water dusty roads, request the contractors to use plants with low emission rates and maintain regularly, cover the trucks, install signboards and fences, arrange people to direct/divert traffic, do not allow trucks to travel

on local roads at peak hours in the morning and afternoon, wash the trucks before leaving the resettlement site,recruit local labours to reduce camp demands,provide adequate accommodation including water supply and sanitation facilities at the camps for the workers to use, provide protective gears for the workers such as cloths, gloves, hats and masks, provide first aid kits at the site, install sedimentation traps to prevent materials from falling to people on the ground, place garbage bins at the site contract licensed dealers to transport the waste to the city's disposal site, place bins for hazardous wastes and handle in accordance with MONRE circular 36/2015/TT-BNTMT regarding hazardous waste management, clean up existing drainage canals before levelling, store construction materials far from pagoda and residential houses, clean up and rehabilitate disturbed areas before construction is completed.

Social impacts will be managed by registering the list of workers with local authorities, minimising disturbed areas, not to use the land outside the project boundary without agreement from local community and authorities, apply codes of conducts to the workers such as forbidden of gambling, drinking, drug usage, involve in prostitutions or other actions that cause harm to local security.

The existing Pho Te Ni Tu pagoda will not be affected by land acquisition but will be affected with dust, noise, increased flooding risks, reduced visuality, values landscape and accessibility during pre-construction, construction and operation phases. Currently there are many trees surrounding the pagoda. To control noise and dust level at the pagoda, 7 houses and related structured located near the pagoda will be watered before demolition, and demolition will avoid the hours and dates when worshiping is going on. Flooding risks at the pagoda will be managed by cleaning up and maintenance of existing drains in the area, construct new drains along the foot of the new roads and install three D800 drainage pipes near the pagoda to drain storm water to the Kim Bong river. Besides, under the direction of the provincial People's Committee, Department of Natural Resources and Environment has cooperate with relevant agencies to report to Provincical PCs for the dredging of Kim Bong river. the dredging of Kim Bong River is urgent in order to reslove regional drainage issue and City PCs are proposed for the in charge of this activity. Currently, PPC are considering the investment proposals on dredging Kim Bong for the implementation of the medium-term plan.

To minimise traffic safety risks and other impacts to the Luong Dinh Cua and Ngoc Hiep Schools, a new access road will be built so as the trucks will not pass the two schools.

The excavated soil will be temporarily stored in barren land in the project site then reused to build slops along the roads. The slopes will be protected and greened with vetiver grass. Some materials generated from demolition activity will be reused or sold to recycling businesses, and the rests will be transported to approved disposal site.

The other potential social and environmental impacts and issues during operation phase of the resettlement site have been considered carefully since the planning stage. For example, land use plan of the resettlement site reserves 37% for residential houses, 52% for roads and drainage canals, 1.7% for schools and 1.6% for parks/green space, 5.8% for schools and market.

Wastewater primarily treated in septic tanks will be led by gravity to the wastewater pumping station located at the southeast of the resettlement area. From there, wastewater will be pumped into the city's wastewater collection pipes. Solid waste from this resettlement site will be collected by URENCO and disposed off at the city's Luong Hoa landfill.

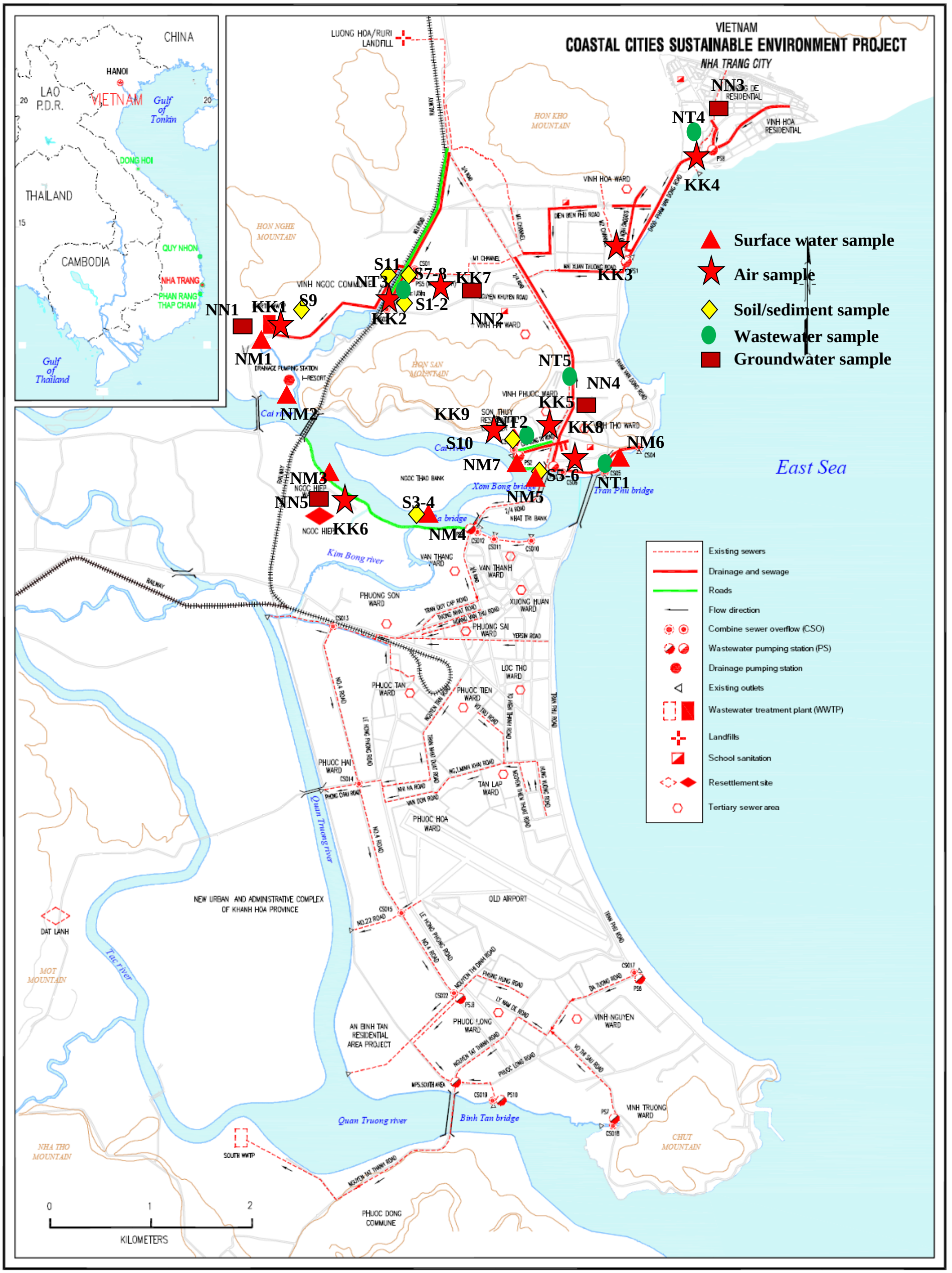
An acceptable plan to regularly monitor and supervise to ensure environmental compliance at the construction sites.

During the preparation of the EIA, consultation with the Ngoc Hiep CPC and local community has been conducted. The CPC requested the project owner to coordinate with local authority during land acquisition and site clearance, fully comply with the commitments set out in the EIA report. The representatives of the affected households requested clarifications about compensation for resettlements, control dust and gas emission from transport, and particularly ensure traffic safety for the students at the two schools. Affected households also requested the PMU to work with Nha Trang CPC about dredging in Kim Bong river.

In conclusion, the EIA for the Ngoc Hiep Resettlement Site meets the requirements of Vietnamese legislations and WB's safety policies.

Appendix4. Diagram Of Sampling Positions

Additional sampling positions of soil and groundwater in Administrative Urban Area


VIETNAM
COASTAL CITIES SUSTAINABLE ENVIRONMENT PROJECT
NHA TRANG CITY
CHINA
HANOI
LAO P.D.R.
VIETNAM
Gulf of Tonkin
DONG HOI
THAILAND
CAMBODIA
QUY NHON
NHA TRANG
PHAN RANG THAP CHAM
Gulf of Thailand
LUONG HOA/RURI LANDFILL
HON KHO MOUNTAIN
HON NGHE MOUNTAIN
HON SAN MOUNTAIN
VINH HOA WARD
VINH NGOC COMMUNE
VINH HA WARD
VINH PHUOC WARD
VINH HOA RESIDENTIAL
NGOC HIEP
NGOC THAO BANK
NHAT TRI BANK
VAN THANG WARD
VAN THANH WARD
PHUONG SON WARD
XUONG HUAN WARD
PHUONG SAI WARD
PHUOC TAN WARD
PHUOC TIEN WARD
LOC THO WARD
PHUOC HAI WARD
TAN LAP WARD
PHUOC HOA WARD
PHUOC LONG WARD
VINH NGUYEN WARD
VINH TRUONG WARD
AN BINH TAN RESIDENTIAL AREA PROJECT
NEW URBAN AND ADMINISTRATIVE COMPLEX OF KHANH HOA PROVINCE
OLD AIRPORT
PHUOC DONG COMMUNE
SOUTH WWTP
DRAINAGE PUMPING STATION
DAT LANH
MOT MOUNTAIN
NHA THO MOUNTAIN
CHUT MOUNTAIN
East Sea
Cai river
Tac river
Quan Truong river
Kim Bong river
Xom Bong bridge
Tran Phu bridge
Binh Tan bridge
NN1
NN2
NN3
NN4
NN5
NM1
NM2
NM3
NM4
NM5
NM6
NM7
NT1
NT2
NT3
NT4
NT5
KK1
KK2
KK3
KK4
KK5
KK6
KK7
KK8
KK9
S1-2
S3-4
S5-6
S7-8
S9
S10
S11
Surface water sample
Air sample
Soil/sediment sample
Wastewater sample
Groundwater sample
Existing sewers
Drainage and sewage
Roads
Flow direction
Combine sewer overflow (CSO)
Wastewater pumping station (PS)
Drainage pumping station
Existing outlets
Wastewater treatment plant (WWTP)
Landfills
School sanitation
Resettlement site
Tertiary sewer area
0
1
2
KILOMETERS

APPENDIX 5- CCSEP Nha Trang Dredged Materials Management Plan

1. Location of Dredging, Volume and Characteristics of Dredged Materials

Dredging area: Northern and Southern bank of Cai river. The volume of dredging mud estimated about 94,000m^3

Several other areas such as balancing lake, stormwater and wastewater pumping station, pipelines, WWTP, traffic road generate about 184,690 m^3 of excavating soil.

There is about 94,000 m^3 dredging mud of Cai river and 25,252 m^3 of excavating soil generates from construction activities of WWTP with the average salinity is about 2.76‰ – 3.5‰)

2. Final Disposal Site

Based on analysis result of sediment/soil samples in Chapter 2, the quality of sediment/soil samples is within allowable limits accrodnig to QCVN 03-MT:2015/BTNMT – National technical regulation on allowable limits of heavy metal in soils (residential area) and QCVN 43:2012/BTNMT – National technical regulation onsediment quality

However, the volume of salty sediment/soil would be proposed to dispose at the Administrative and Urban Center of Khanh Hoa province. The salinity of sediment/soil in this location is similar to deredging sediment/soil of Cai river (2.76‰ – 3.5‰). The volume of remaining soil would be disposed at Luong Hoa diposal site.

The disposal site is away 6 to 11 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 (m3)	***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 SO2, H2S, 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 nuisance	- 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 the construction corridor determined for each canal section

Impacts and Description	Mitigation Measures
	- 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 and

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.	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	

Impacts and Description	Mitigation Measures
Landslide and soil subsiding risks at final Disposal site 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	- Level the materials after being disposed off - Slopes of the dumps will not be steeper than 45o - 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 - Saline dredged materials will be disposed off at the Administrative and Urban Center of Khanh Hoa province. The elevation of Administrative and Urban Center of Khanh Hoa province (126ha) is currently lower than road surface of PhongChau road (about 3-4m). There are no agricultural activities in this area due to salty soil, its distance to residential area and Quan Truong river respectively is about 200m and 500m. - 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.	- The excavated materials will be finally disposed off at sites and with conditions described below: - The kinds of other soil (expect saline soil) would be disposed at Luong Hoa disposal site (away 6-11km of distance from dredging area) - Saline dredged sediment/soil of Cai river, WWTP would be disposed at the Administrative and Urban Center of Khanh Hoa province - Apply measures that ensure rainwater onto the saline 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 Administrative and Urban Center of Khanh Hoa province

- 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.
- As for the sections with acid sulphate soil or potential acid sulphate soil, the following measures should be considered: dredging should be carried out in the rainy season when more fresh water could be available for diluting acidic water; Treating acidic water in the disposal areas before returning effluent to the canals; and proper locate and design of the disposal area not to affect the nearby agricultural land.
- 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